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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1161

TESTS OF SLOTTED TUBE CATAPULTS

8th Partial Report

- -

XC MARK I CATAPULT-HYDROGEN PEROXIDE TESTS

FINAL Report

Task Assignment NPG-Re5a-37-1-53

Copy No. 11

Classification CONFIDENTIAL, SECURITY INFORMATION

NPG REPORT NO. 1161

XC Mark 1 Catapult-Hydrogen Peroxide Tests

PART A

SYNOPSIS

1. The effect of injecting hydrogen peroxide solutions into the chamber of a catapult during burning of the propellant was investigated experimentally in a large-volume closed bomb. Solutions of hydrogen peroxide in water, in concentrations varying from zero to 60 per cent, were tested and oscillograms of pressure and thermocouple temperatures versus time were obtained. Large scale graphs of pressure-time histories for individual rounds are reproduced for detailed study and reference.

2. It is concluded that:

a. Hydrogen peroxide solutions, injected during burning of conventional propellants, exhibit properties both as a propellant and as a coolant to a significant degree. Under closed chamber conditions, a quantity of solution equal in weight to one-half the charge weight can be utilized to maintain the peak pressure with a reduction of the order of four per cent in absolute temperature, to nearly double the pressure with an increase in absolute temperature of only ten per cent, or to yield intermediate effects by adjusting the concentration of the solution between zero and 60 per cent.

b. A solution concentration of ten per cent is ample for the complete elimination of carbon formation in the chamber.

c. Consistent operation of an injection system in service will require a positive means of controlling the time of injection and of insuring that the injector is fully discharged. If gas from the main charge is to ignite the auxiliary charge, the size of ignition passages is an important factor in obtaining uniform injection. Under the conditions of these tests, a 3/16" diameter passage proved to be barely adequate.

d. Synthetic materials used for experimental injector piston seals (Neoprene and Teflon) must be protected from the combined action of hot gases and free oxygen in order to attain satisfactory life. Two relatively simple methods show promise as protective measures: (1) covering the exposed surface with pure aluminum foil, and (2) complete initial submersion of the seal in the liquid.

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XC Mark 1 Catapult-Hydrogen Peroxide Tests

PART B

INTRODUCTION

1. AUTHORITY:

The work reported herein was conducted under Task Assignment No. NPG-Re5a-37-1-53 as established by reference (a). Specific authority for the tests is contained in reference (b).

2. REFERENCES:

a. BUORD ltr Re5a-RMS:djs of 7 August 1952
b. BUORD ltr S83 Ser 38549; Re5a-EOS:cmj of 30 April 1952
c. NPG Report No. 999 "XC Mk 1 Water Tests" of 14 July 1952
d. BUORD Sketch No. 238834-XC Mk 1 Catapult, Test Model Details
e. BUORD Sketch No. 329212, XC Mk 1 Catapult Test Model Water Injector Plug

3. BACKGROUND:

As a means of reducing flame temperatures and secondary explosions in catapults, the injection of water into the chamber during burning has been proposed by the Bureau of Ordnance. The effect of water injection was investigated theoretically by the Atlantic Research Corporation, and in experimental closed bomb tests at the Naval Proving Ground. Injected water was found to cause formation of a heavy residue of carbon in the chamber, and to require an increase in the propellant charge in order to maintain the pressure at the same value as that obtained on firings without injection. As a means of reducing the charge weight and, at the same time preventing carbon formation, it was proposed that water-hydrogen peroxide mixtures be used instead of water alone. By reference (b) the Naval Proving Ground was requested to conduct closed bomb firings to determine the effect of injecting H_2O-H_2O_2 mixtures in concentrations from zero to 60 per cent, with a constant propellant weight and constant weight of injected liquid.

4. OBJECT OF TESTS:

The object of these tests was to investigate the charateristics of H_2O-H_2O_2 injection by firing charges of 16" granulation propellant in a closed chamber, and injecting into the chamber during burning known weights of hydrogen peroxide solution with concentrations of 0, 10, 20, 30, 40, 50 and 60 per cent. Of particular interest was the recording of peak pressures and pressure-time curves during and after firing for all conditions. It was also desired to record such temperature data as could be obtained without delaying the tests. During the course of the experiments, it became necessary also to investigate the design of sealing elements for the injector piston.

5. PERIOD OF TEST:

a.	Date of Project Letter	7 August 1952
b.	Date of Specific Directive	30 April 1952
c.	Date Commenced Test	5 January 1953
d.	Date Test Completed	8 May 1953

PART C

DETAILS OF TEST

6. DESCRIPTION OF TEST EQUIPMENT:

a. All rounds were fired in the XC Mk 1 Catapult test chamber. This chamber was used on prior tests with water injection, reported in reference (c). It is essentially a cylindrical closed bomb with an inside diameter of 9.50 and an inside length of 80.0. At one end is a breech cap, which is tapped to receive three electric primers, equally spaced on a 6" diameter circle, one dynamic pressure gage, one probe type thermocouple, and one bleeder plug. At the other end is a closing cap. Appendix (A), Figure 1 is a diagram of the test arrangement. Reference (d) is a detail of the chamber.

b. The water injector is a steel tube 33" long, with an inside diameter of 3" and an outside diameter of 4", and is fitted with a brass piston which divides it into two compartments. The compartment behind the piston, designed to contain an auxiliary charge of powder which yields the pressure required for injection, is pierced with two holes which provide for ignition of this charge. The chamber in front of the piston is designed to contain a quantity of liquid, and terminates in a spray head pierced by ninety-six 1/16" diameter holes which are arranged to spray the liquid upward and forward at an angle of 16° with the horizontal into the catapult chamber. Reference (e) is a detail drawing of the spray head. In operation, the injector is loaded with the liquid solution and smokeless powder and placed inside the catapult chamber together with the main chamber charge. The main chamber charge is ignited by means of three Mk 42 electric primers. When the pressure and temperature in the catapult chamber begin to rise, the hot gases pass through the ignition holes in the injector cylinder and ignite the auxiliary charge. This charge forces the piston forward, thereby forcing the hydrogen peroxide solution out through the holes in the spray head. Appendix (A), Figure 2, is a photograph of the spray injector.

c. The pressure-time and temperature-time records were taken on an electromagnetic recording oscillograph with associated wheatstone bridges and d.c. amplifiers.

d. A probe thermocouple was constructed for comparative temperature measurements. Number 30 iron-constantan thermocouple wire was passed through a hole 0.046 diameter on the axis of a stainless steel rod (probe) of 1" length and 0.090 diameter and was welded by means of a carbon arc, each wire emerging from the welding bead with no contacts between the welding bead and the asbestos insulation. The welded wires were then pulled back into the 0.052 countersink at the top. A seal against gas pressure was obtained by metallic arc using 25-20 stainless steel electrodes. The end of the probe was machined to a diameter of 0.175 to facilitate this welding. After welding, the enlarged end was ground to approximately 0.090 to increase the speed of response. The probe was not protected during the first three firings (rounds 17, 18 and 19) and was bent to an angle of about 10° in each firing, apparently by the impact of the powder grains. Thereafter, a shield was placed around the probe, which protruded only 1/4", and this prevented the bending observed in previous rounds. Appendix (A), Figures 3, 4 and 5 show the details and photographs of the thermocouple assembly.

8. PROCEDURE:

a. The main charge to be used in all firings was established at six pounds of 16" master standard powder, index IHIC-14, and the weight of injected liquid at three pounds. Three pounds of liquid represent slightly more than half of the injector capacity. The remaining air space was considered necessary to facilitate filling and sealing by personnel who had no previous experience in handling peroxide. With the experience gained on these firings, it should be possible to utilize up to 90 per cent of the full capacity on future tests.

b. Five or more rounds were fired at each of 7 different concentrations of liquid, beginning at zero per cent (distilled water) and increasing the H_2O_2 concentration in increments of ten per cent until a concentration of 60 per cent had been fired. In addition, several rounds were fired without liquid injection for the purpose of comparison. The auxiliary charges used to actuate the injection chamber were composed of from two to six grains (approx. 0.16-0.50 lb.) of the 16" powder. One gram of SR-4990 (pistol powder) was added to each auxiliary charge to aid in ignition. The closing of the firing key, the pressures and the temperatures were recorded with respect to time. Other details of firing procedures are tabulated in Appendix (B), Table I.

c. Since hydrogen peroxide is corrosive and attacks steel, Fluorolube oil ("S") and Fluorolube heavy grease (Gr544) were used to reduce this corrosive action. Fluorolube oil was used to swab the wall area in front of the piston. Fluorolube heavy grease was used to fill the spray holes in the injector head. These materials have been recommended by the supplier, Buffalo Electro-Chemical Company, Inc., for long time contact with 90 per cent H_2O_2. Some corrosive action occurred on the inside chamber of the spray injector, but the corrosion was not severe enough to affect the operation of the device.

d. The Neoprene seal used on the injector piston withstood the effects of firing at concentrations of 10 and 20 per cent without significant damage. The same seal failed on the first round in which a 30 per cent concentration was used. A new seal was installed before firing the second round at 30 per cent concentration, and was found, after firing, to be badly deteriorated, charred and cracked. The deterioration was most pronounced, in both cases, at the surface which was above the initial level of the liquid. On round 17 a 1/4" thick Teflon seal was used. After firing, the seal was slightly eroded, indicating that gases had escaped around the edges. There were brown discolorations on the area above the liquid level. On round 18, there were additional brown discolorations and the edges were eroded somewhat more. On round 19, about three-fourths of the area of the seal that was originally above the liquid level was eroded and in a concave shape (facing liquid). This seal was unfit for further use. Appendix (A), Figure 6 is a photograph of the conditions of the three seals used on rounds 15-19. New Teflon seals were used on rounds 20 and 21 and were eroded in a similar manner. On round 22, two 1/8" thick Neoprene cup seals facing in opposite directions were used, protected by a stainless steel disc and aluminum foil bolted to the piston, and tucked into the reservoir around the steel disc and Neoprene. The steel disc and aluminum foil were used to protect the Neoprene seals and help dissipate the heat, as well as to form a reservior for the fluorolube grease and oil. No apparent damage occurred to the seals. A Neoprene buffer ring was installed to protect the disc. After firing, the upper half of this ring was missing. On the following round, the buffer ring was made of copper, and this ring functioned satisfactorily for the remainder of the tests. Figure 7 is a photograph of seals used on rounds 20-24.

e. The liquid injector was originally provided with two 1/8" diameter holes adjacent to the auxiliary charge position, for ignition of this charge. A third hole of the same diameter was provided at the bottom of the auxiliary chamber, but was ineffective as an ignition hole because it terminated at the chamber wall. Before beginning these tests, one of the ignition holes was enlarged to 3/16" diameter in an attempt to improve the ignition of the auxiliary charge.

9. RESULTS AND DISCUSSION:

a. The results of firing tests with liquid injection are tabulated in Appendix (B), Table II. Table III shows comparative results for a group of similar rounds fired without injection.

b. The effect of H_2O_2 concentration on peak pressure is shown graphically in Appendix (C), Figure 8. Peak pressures of all rounds are plotted as individual points on this graph, and a curve has been faired through the mean values. Reference to Figure 8, and Tables I and II, shows that the injection of a 3-lb. charge of pure water reduces the peak pressure 10 per cent below that obtained without injection. A 10 per cent solution of H_2O_2 is sufficient to restore the pressure to the value obtained without injection and further increases in H_2O_2 concentration produce proportional increases in the peak pressures. The increment of pressure for each one per cent increase in H_2O_2 concentration is 43 psi.

c. The effect of concentration on temperature is shown in Figure 9. Here the mean values of the peak recorded temperatures for each concentration are plotted, together with a vertical line connecting the highest and lowest of the individual readings. Although the trend of the curve is not as well defined as in the case of pressures, a straight line provides a good fit. The injection of pure water reduces the recorded temperature 8 per cent below that obtained without injection, and the addition of H_2O_2 increases the temperature in increments of 2.9°C for each 1 per cent increase in concentration. It is important to note that the peak temperatures recorded are significant only as a means of comparing the relative heating effects under varying conditions. Quantitatively, the temperatures recorded are not those of the combustion products but rather of the thermocouple itself which, because of an inherent time lag, does not reach equilibrium until the gas temperature has dropped below its peak. In the case of closed bomb firings such as these, an analytical method of correcting the thermocouple readings is available, but it has not been applied because the actual readings are equally effective for comparing different rounds fired in the same chamber.

d. To facilitate detailed study of the burning characteristics under varying injection conditions, pressure-time and temperature-time curves have been plotted for all rounds individually. Two graphs are provided for each round. The first, using a normal time scale, shows the pressure rise, peak, and early stage of decay, covering an interval of two seconds from closing of the firing key. The second uses a compressed time scale in order to accentuate the shape of the decay curve, and shows the pressure and temperature for an interval of 15 seconds from closing of the firing key. The first set of curves is reproduced in Appendix (C), Figures 10-64, inclusive, and the second set in Appendix (D), Figures 65-120, inclusive.

e. The formation of a carbon residue, which had been observed on all firings with water injection and to a lesser extent, on firings without injection, was not observed on any of the firings where H_2O_2 was used. The liquid which remained in the chamber after injecting H_2O_2 was light brown in color, and was readily removed by swabbing and flushing, leaving the metal bright and clean.

f. Operation of the liquid injector is not positive. Variations in its operation are the most probable cause of round-to-round dispersion in pressures and temperatures. However, the consistency of operation during this series of tests was much improved over that of earlier tests. This was due to two factors: (1) the improved ignition achieved by enlargement of one of the ignition holes from 1/8" to 3/16" diameter, and (2) the use of effective, liquid-tight seals ahead of the spray piston. It was found necessary to increase the auxiliary charge progressively as the concentration of H_2O_2 was increased, to prevent short travel of the piston. Ultimately, the charge was increased to 6 grains of 16" powder (0.5 lb.).

g. Of the two materials used as experimental seals for the injector piston, Teflon is more resistant to deterioration than Neoprene; however, neither material has a satisfactory life when used without protection. The flexibility of Neoprene made it more adaptable than Teflon to the special protective measures which finally resulted in a satisfactory seal life, as described in paragraph (8-d). The deterioration of the seals was considerably greater in the area above the liquid level than in the area below. In the case of Teflon, deterioration was almost entirely confined to the upper area. This indicates that the damage occurred before injection, and resulted from impingement of gases from the main charge on this area. These gases, having traversed the surface of the liquid, would be rich in oxygen and very active. This suggests another method of increasing the life of seals: tilting the injector so that the sealing element is initially covered by liquid.

PART D

CONCLUSIONS

10. a. Hydrogen peroxide solutions, injected during burning of conventional propellants, exhibit properties both as a propellant and as a coolant to a significant degree. Under closed chamber conditions, a quantity of solution equal in weight to one-half the charge weight can be utilized to maintain the peak pressure with a reduction of the order of four per cent in absolute temperature, to nearly double the pressure with an increase in absolute temperature of only ten per cent, or to yield intermediate effects by adjusting the concentration of the solution between zero and 60 per cent.

b. A solution concentration of 10 per cent is ample for the complete elimination of carbon formation in the chamber.

c. Consistent operation of an injection system in service will require a positive means of controlling the time of injection and of insuring that the injector is fully discharged. If gas from the main charge is to ignite the auxiliary charge, the size of the ignition passages is an important factor in obtaining uniform injection. Under the conditions of these tests, a 3/16" diameter passage proved to be barely adequate.

d. Synthetic materials used for experimental injector piston seals (Neoprene and Teflon) must be protected from the combined action of hot gases and free oxygen in order to attain satisfactory life. Two relatively simple methods show promise as protective measures: (1) covering the exposed surface with pure aluminum foil, and (2) complete initial submersion of the seal in the liquid.

PART E

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XC Mark 1 Catapult-Hydrogen Peroxide Tests

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NPG REPORT NO. 1161

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Eighth Partial Report

on

Tests of Slotted Tube Catapults

- -

Final Report

on

XC Mark 1 Catapult-Hydrogen Peroxide Tests

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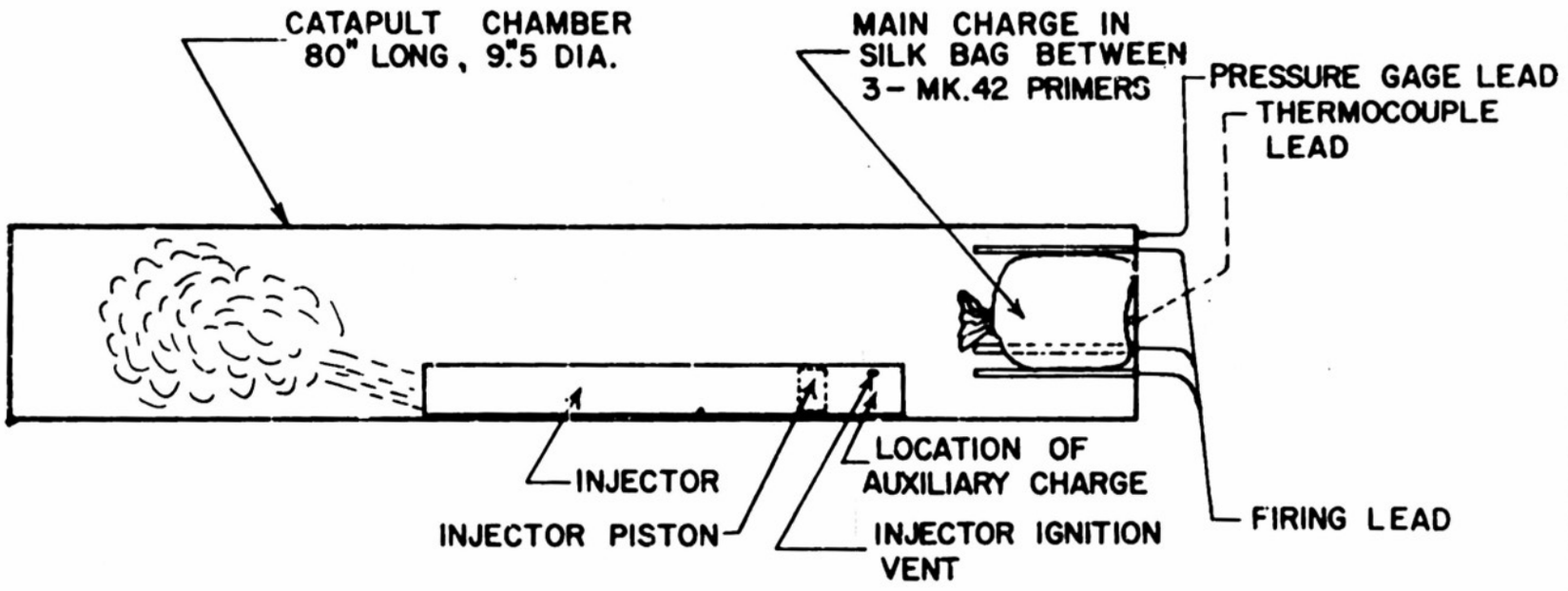


XC MARK I CATAPULT
ARRANGEMENT OF TEST CHAMBER AND INJECTOR

FIGURE I

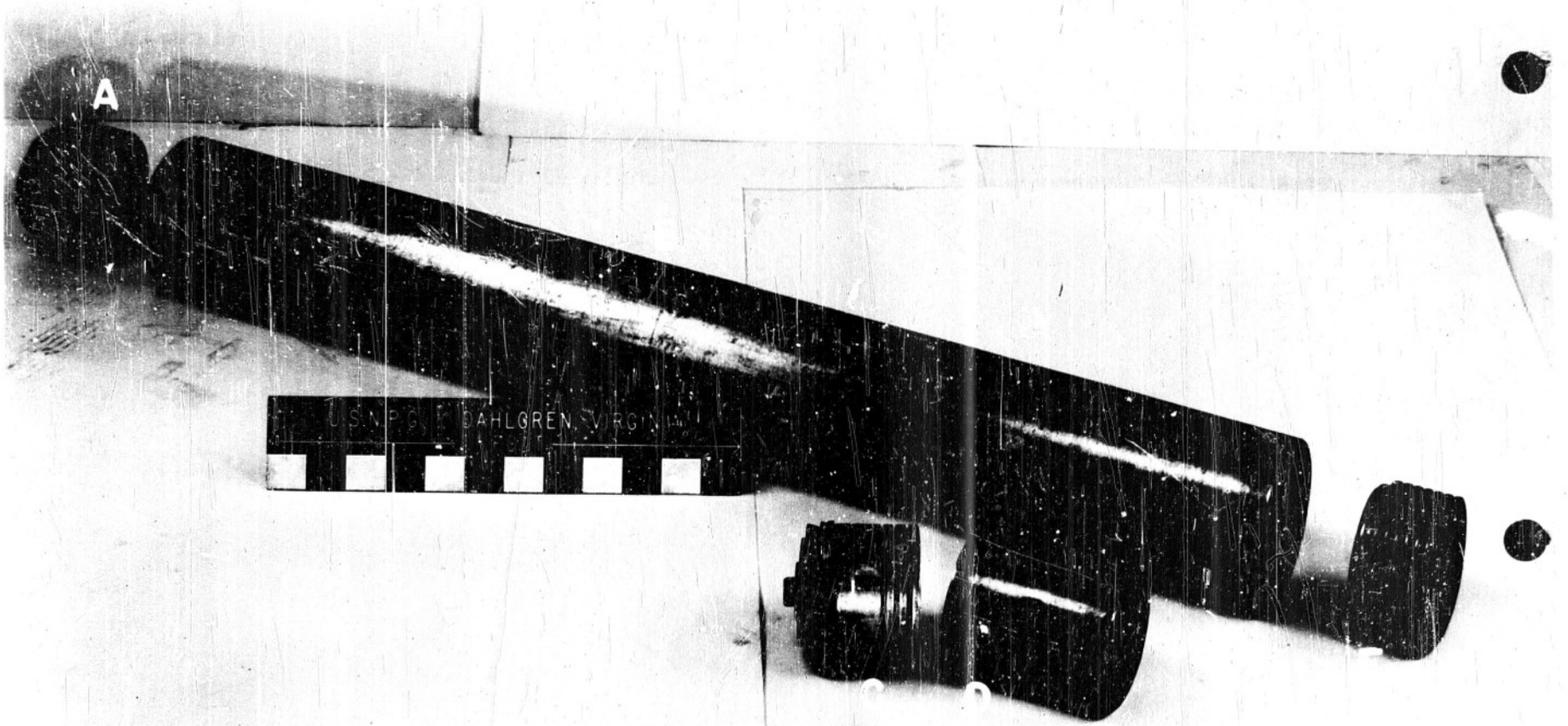
NP-62043 SECURITY INFORMATION

XC-MK-1 CATAPULT
Hydrogen-Peroxide Tests

Photo of Test Model Injector and Components: (A) Nozzle, (B) Injector, (C) Piston with Stainless Steel Cloth Ring, Disc, and Cup Seals, (D) Sleeve, (E) Breech Cap

Air Force Photo

May 1952



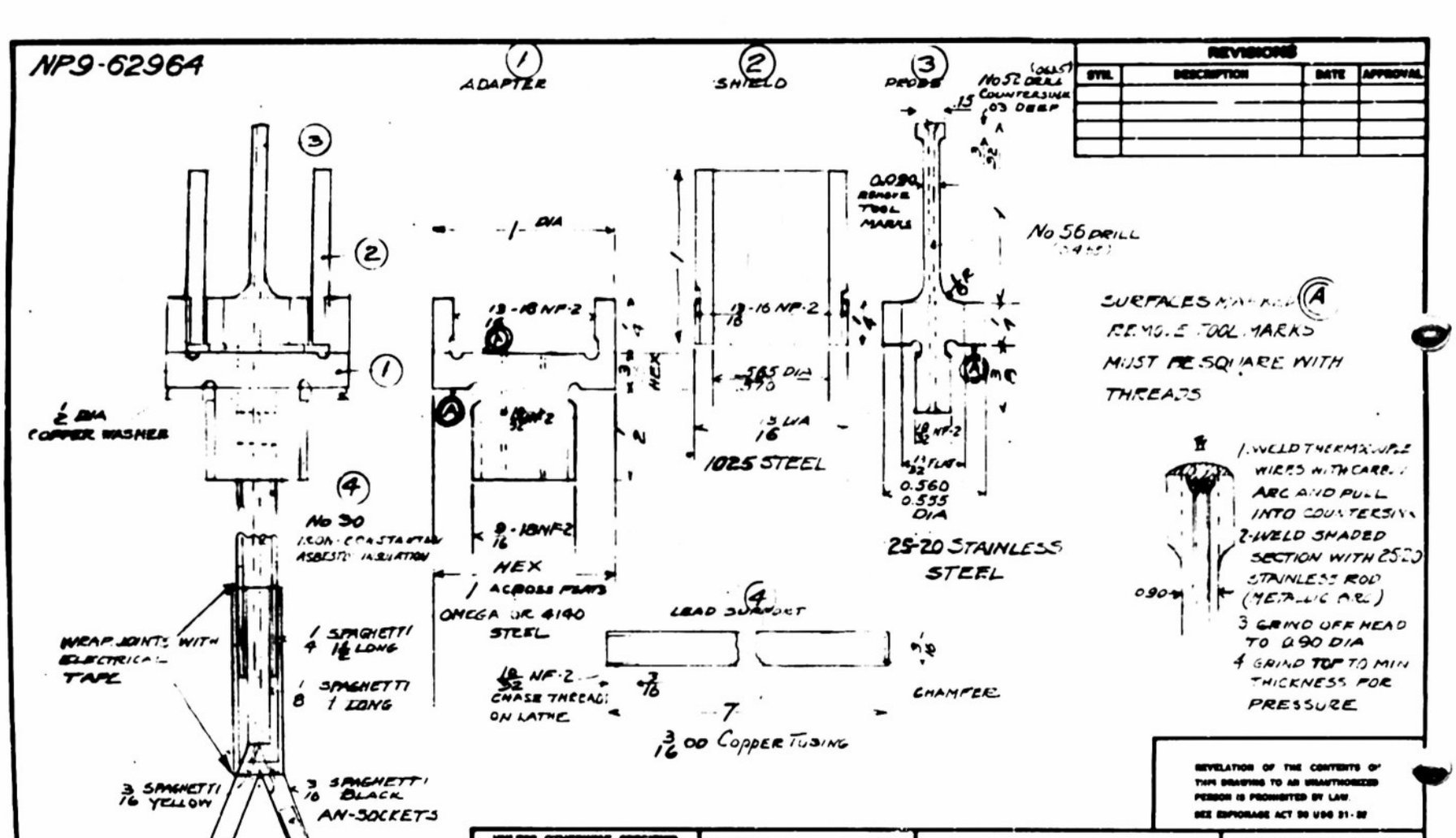


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FIG. 3

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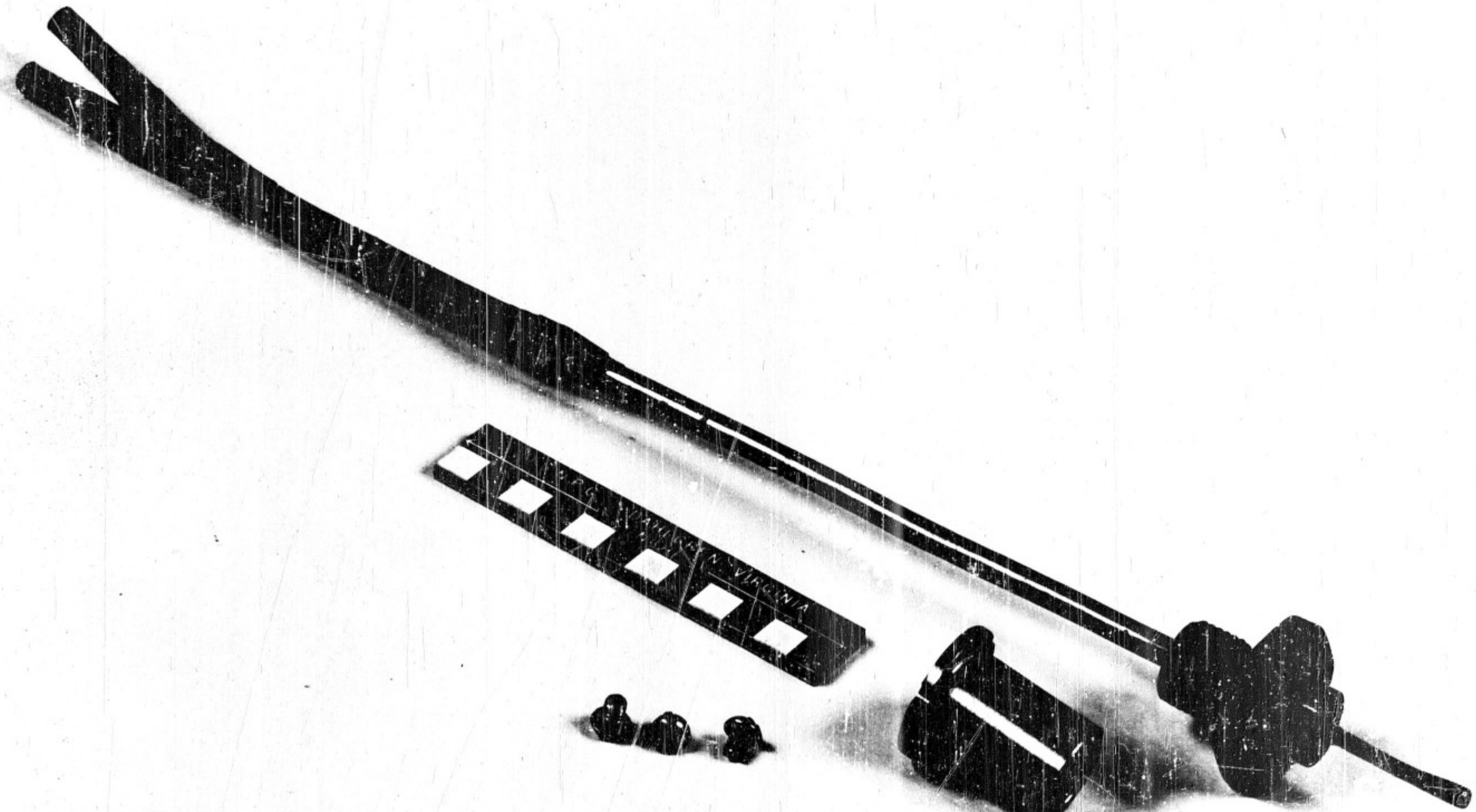
Probe Tube Thermocouple [illegible]

[illegible] (A) [illegible] (D) Probe [illegible] thermocouple [illegible] thermocouple [illegible] support [illegible]

[illegible] March 195[illegible]



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XC Mark 1 Catapult
Probe Type Thermocouple

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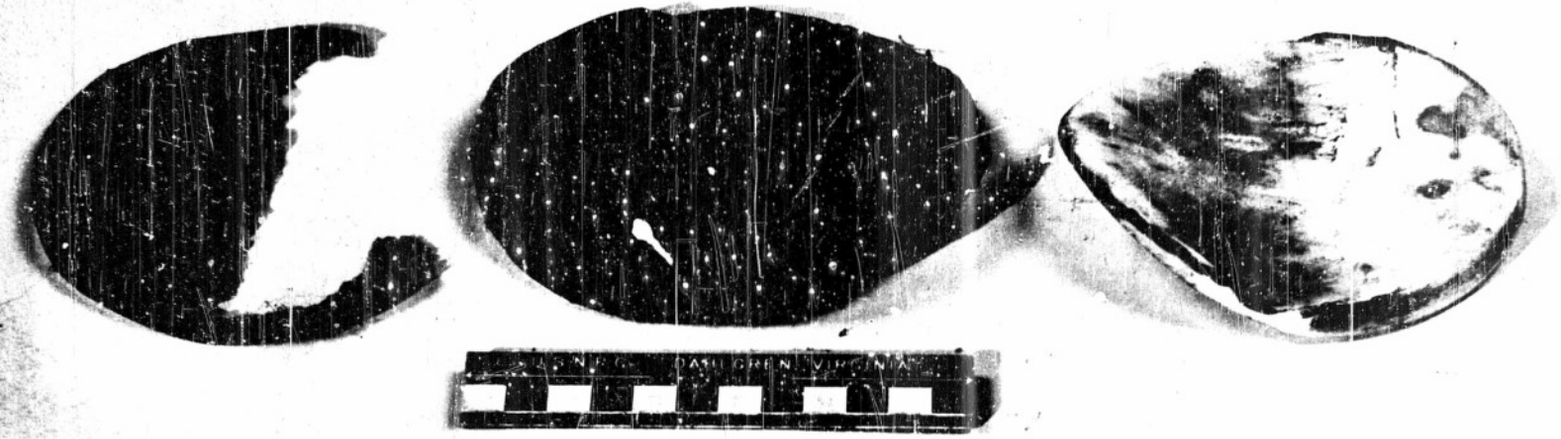
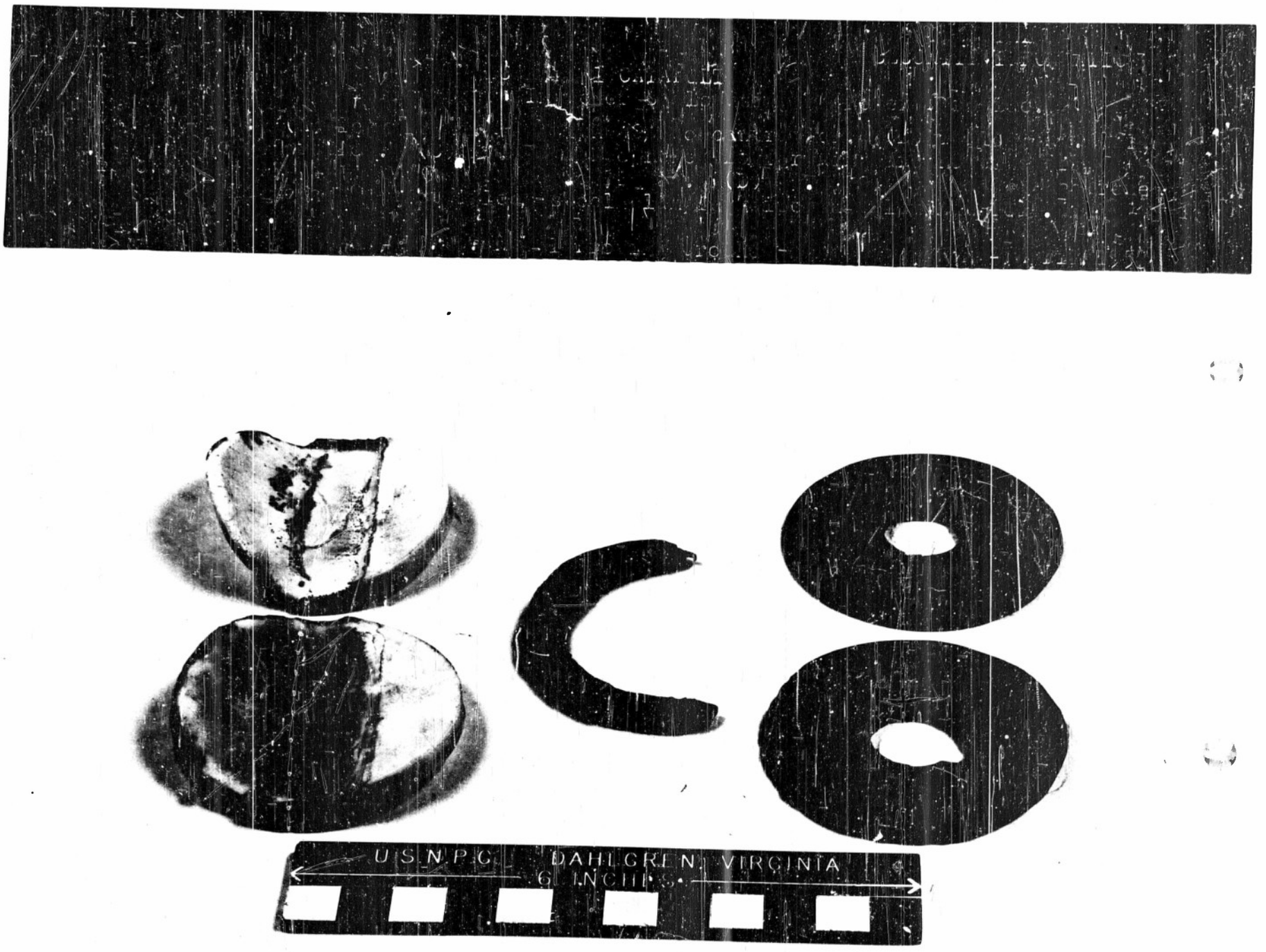
Assembly of shield, probe, adapter and fixed lead support.
Figure 5

U. S. Naval Proving Ground

March 1953

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XC Mark 1 Catapult-Hydrogen Peroxide Tests

TABLE I

XC MARK 1 CATAPULT-HYDROGEN PEROXIDE INJECTION CHRONOLOGICAL SUMMARY OF TESTS

Main Charge: 6.0 lb. of 16" Powder, Index IHIC-14
Injection: 3.0 lb. of solution
Aux. Charge: 16" Powder, Index IHIC-14, as noted.
Ave. weight per grain: 0.083 lb.
Igniter for Aux. Charge: 1.0 gm. of Pistol Powder SR-4990
Primers: Three, Mark 42.

1953 Date	Round No.	H_2O_2 Conc. %	Grains Aux. Charge	Travel of Spray Piston	Remarks
1/5	1	0	2	---	Instrumentation Check-Reduced Charge.
1/6	2	0	2	---	" " "
1/7	3	0	2	Full	
1/14	4	10	2	"	Neoprene seal installed before this round.
1/20	5	10	2	Short (1")	
1/22	6	10	4	Full	
"	7	10	4	"	Hangfire. Seal damaged by impact and replaced.
1/28	8	10	4	"	
"	9	10	4	"	
2/4	10	20	4	"	
2/6	11	20	4	"	
2/10	12	20	4	"	
2/19	13	20	4	"	
3/6	14	20	4	"	
3/10	15	30	4	"	Seal partially consumed. See Paragraph 8d.
3/11	16	30	4	"	" " "
3/13	17	30	4	"	Teflon seal used.
3/16	18	30	4	"	
3/17	19	30	4	"	
3/19	20	40	4	Short (2")	
3/21	21	40	4	"	
3/26	22	40	4	Full	
4/1	23	40	4	Short	
4/3	24	40	4	Short	New neoprene seals. See Paragraph 8d.

XC Mark 1 Catapult-Hydrogen Peroxide Tests

TABLE I (Continued)

1953 Date	Round No.	H_2O_2 Conc. %	Grains Aux. Charge	Travel of Spray Piston	Remarks
4/8	25	50	5	Short	
4/10	26	30	5	Full	
"	27	50	6	"	
4/14	28	50	6	"	
"	29	50	6	"	
4/15	30	50	6	"	
4/16	31	60	5	"	
"	32	--	-	---	Fired to test optical pyrometer.
4/17	33	60	5	Full	
"	34	--	-	---	Fired to test optical pyrometer.
4/20	35	60	5	Short	
4/21	36	60	6	Full	
"	37	--	-	---	Fired to test optical pyrometer.
"	38	30	5	Full	
4/22	39	60	6	"	
"	40	--	-	---	Fired to test optical pyrometer.
4/23	41	60	6	Full	
"	42	20	5	"	
4/24	43	20	5	"	
"	44	10	5	"	
4/29	45	10	5	"	
4/30	46	10	5	"	
"	47	--	-	---	
5/1	48	40	6	Full	
5/4	49	40	6	"	
"	50	40	6	"	
5/5	51	40	6	"	
"	52	40	6	"	
5/7	53	0	6	"	Pressure not recorded.
"	54	0	6	"	
"	55	0	6	"	
"	56	0	6	"	
5/8	57	0	6	"	
"	58	0	6	"	

TABLE II

XC MARK 1 CATAPULT-HYDROGEN PEROXIDE INJECTION TABULATION OF MAXIMUM PRESSURES AND TEMPERATURE RISE

Weight of Main Charge: 6.0 lb.
Weight of Injected Solution: 3.0 lb.

Conc. of Solution %	Rd. No.	Figures	Temp. Rise of Thermocouple °C.	Mean Temp. Rise, °C	Max. Pres. PSI	Mean P_{max} PSI	Remarks
0	3	17,72	---		3525		Atypical. Injection probably late. Included in mean.
"	54	18,74	735		2860		
"	55	19,75	780		2950		
"	56	20,76	775		2995		
"	57	21,77	785		3065		
"	58	22,78	815	780	3065	3075	
10	4	23,79	---		3400		
"	5	24,80	---		3550		
"	6	25,81	---		3075		
"	8	26,82	---		3325		
"	9	27,83	---		3150		
"	44	28,84	---		3525		
"	45	29,85	750		3495		
"	46	30,86	750	750	3405	3370	
20	10	31,87	---		3850		
"	11	32,88	---		4035		
"	12	33,89	---		3800		
"	13	34,90	---		4000		
"	14	35,91	---		3865		
"	42	36,92	775		4110		
"	43	37,93	905	840	4110	3970	

XC Mark 1 Catapult-Hydrogen Peroxide Tests

TABLE II (Continued)

Conc. of Solution %	Rd. No.	Figures	Temp. Rise of Thermocouple °C.	Mean Temp. Rise, °C	Max. Pres. PSI	Mean Pmax PSI	Remarks
30	15	38,94	---		4080		
"	16	39,95	---		4475		
"	17	40,96	985		4575		
"	18	41,97	890		4475		
"	19	42,98	930		4310		
"	26	43,99	855		4600		
"	38	44,100	845	900	4510	4440	
40	20	45,101	835		4600		
"	21	46,102	875		4660		
"	22	47,103	880		4355		
"	23	48,104	880		4600		
"	24	49,105	905		4630		
"	48	50,106	825		4845		
"	49	51,107	890		5030		
"	50	52,108	895		5000		
"	51	53,109	970		5030		
"	52	54,110	925	890	5000	4775	
50	25	55,111	950		5150		
"	27	56,112	885		5150		
"	28	57,113	855		5000		
"	29	58,114	925		5335		
"	30	59,115	905	905	5365	5200	
60	31	---	---		5920		
"	33	60,116	1010		5645		
"	35	61,117	1000		5335		
"	36	62,118	895		5800		
"	39	63,119	940		5950		
"	41	64,120	935	955	5610	5700	

TABLE III

XC MARK 1 CATAPULT-DRY ROUNDS
TABULATION OF MAXIMUM PRESSURES AND TEMPERATURE RISE

Charge Weight: 6.0 lb., 16"/50 Index IHIC-14

Rd. No.	Figures	Temp. Rise of Thermo-couple °C	Mean Temp. Rise °C	Max. Pres. PSI	Mean P_{max} PSI	Remarks
32	10,65	845		3465		Fired to check Pyrometer instrumentation.
34	11,66	875		3375		" " "
37	12,67	835		3340		" " "
40	13,68	845		3375		" " "
47	14,69	820	845	3465	3405	Fired to check Ceramic type thermocouple.

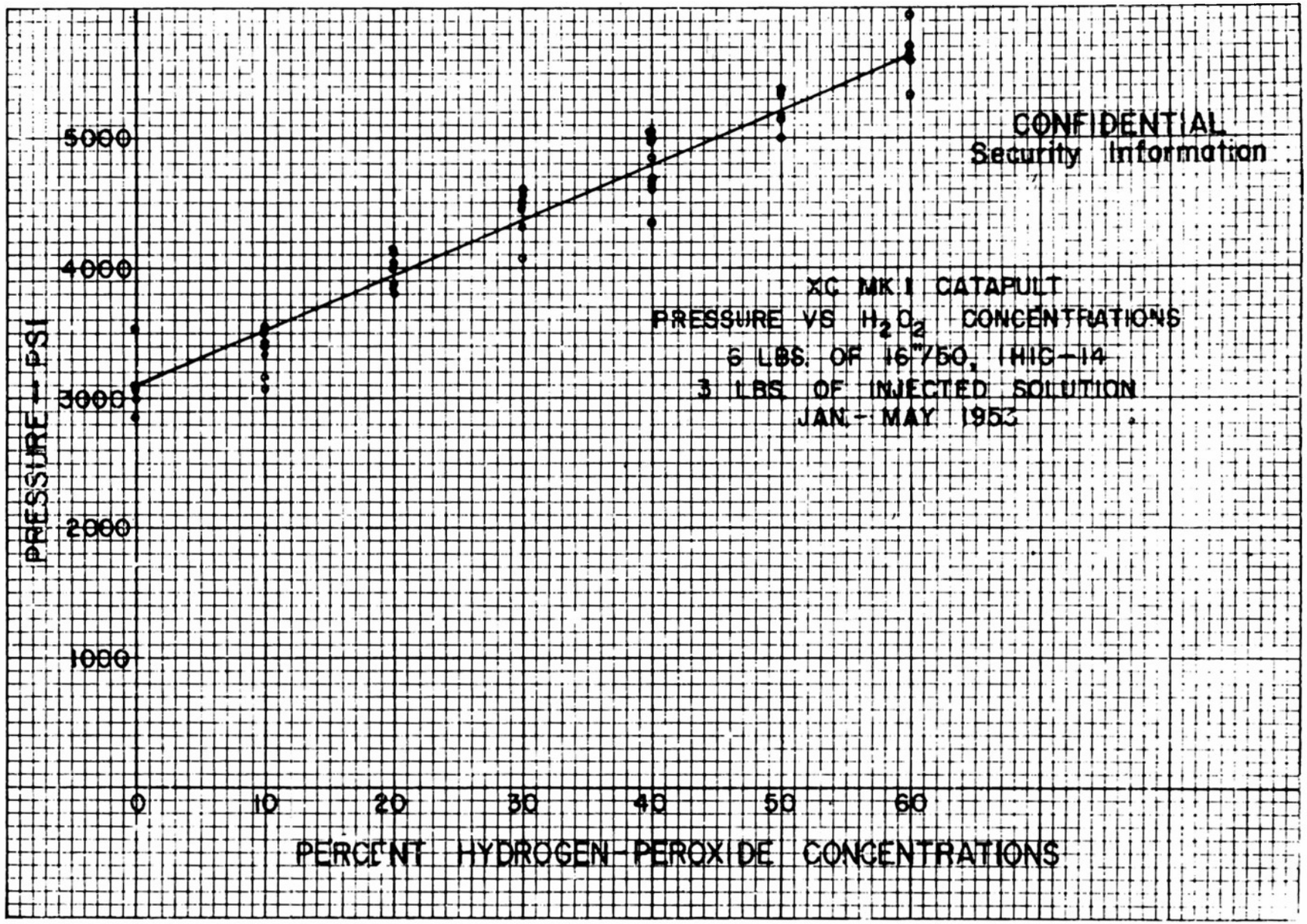
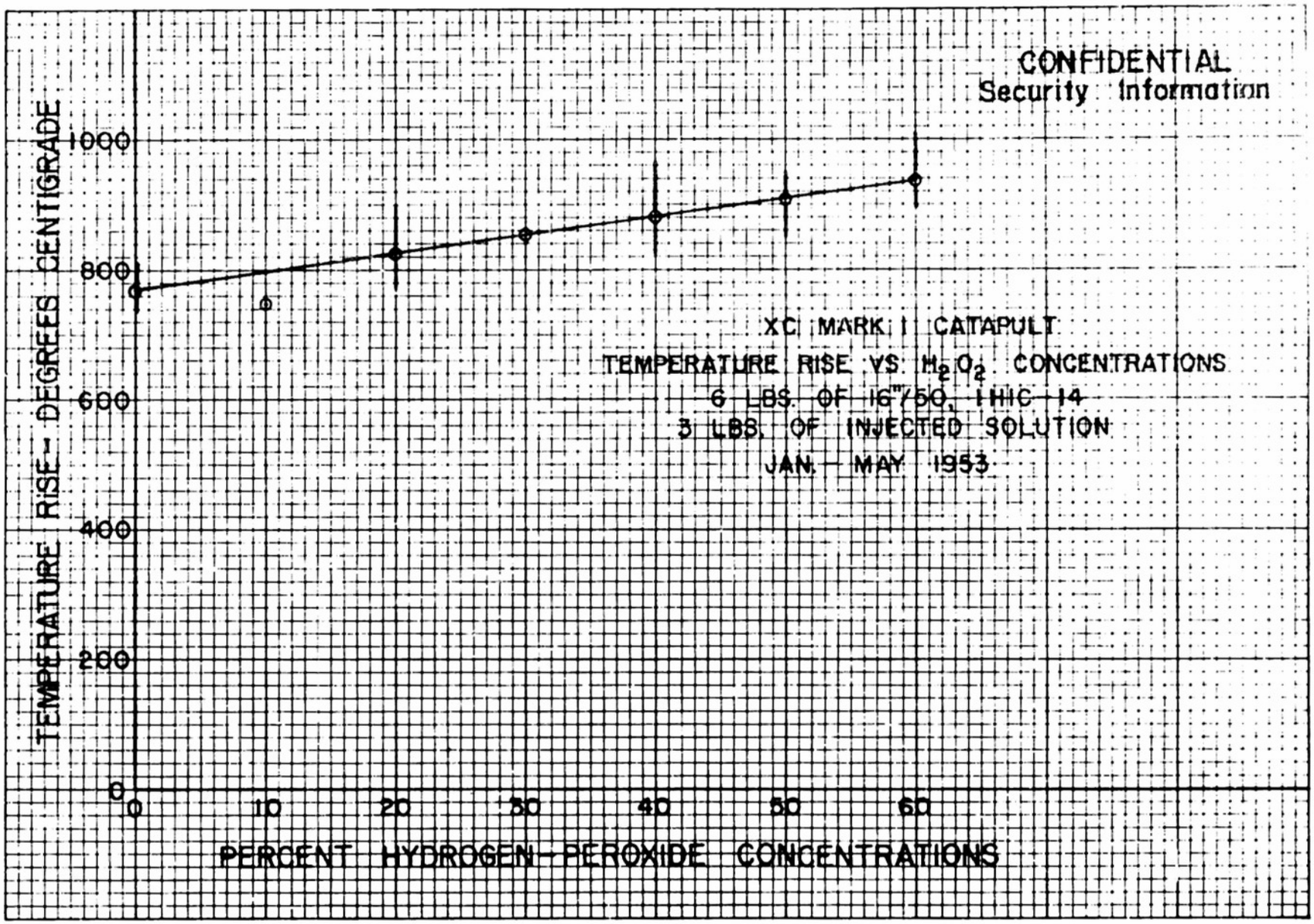

CONFIDENTIAL
Security Information
XC MK I CATAPULT
PRESSURE VS H_2O_2 CONCENTRATIONS
6 LBS. OF 16"/50, IHIC-14
3 LBS. OF INJECTED SOLUTION
JAN. - MAY 1953
PRESSURE - PSI
5000
4000
3000
2000
1000
0
10
20
30
40
50
60
PERCENT HYDROGEN-PEROXIDE CONCENTRATIONS

FIGURE 8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Security Information
XC MARK I CATAPULT
TEMPERATURE RISE VS H_2O_2 CONCENTRATIONS
6 LBS. OF 16"/50, IHIC-14
3 LBS. OF INJECTED SOLUTION
JAN. - MAY 1953
TEMPERATURE RISE - DEGREES CENTIGRADE
1000
800
600
400
200
0
0
10
20
30
40
50
60
PERCENT HYDROGEN-PEROXIDE CONCENTRATIONS

FIGURE 9

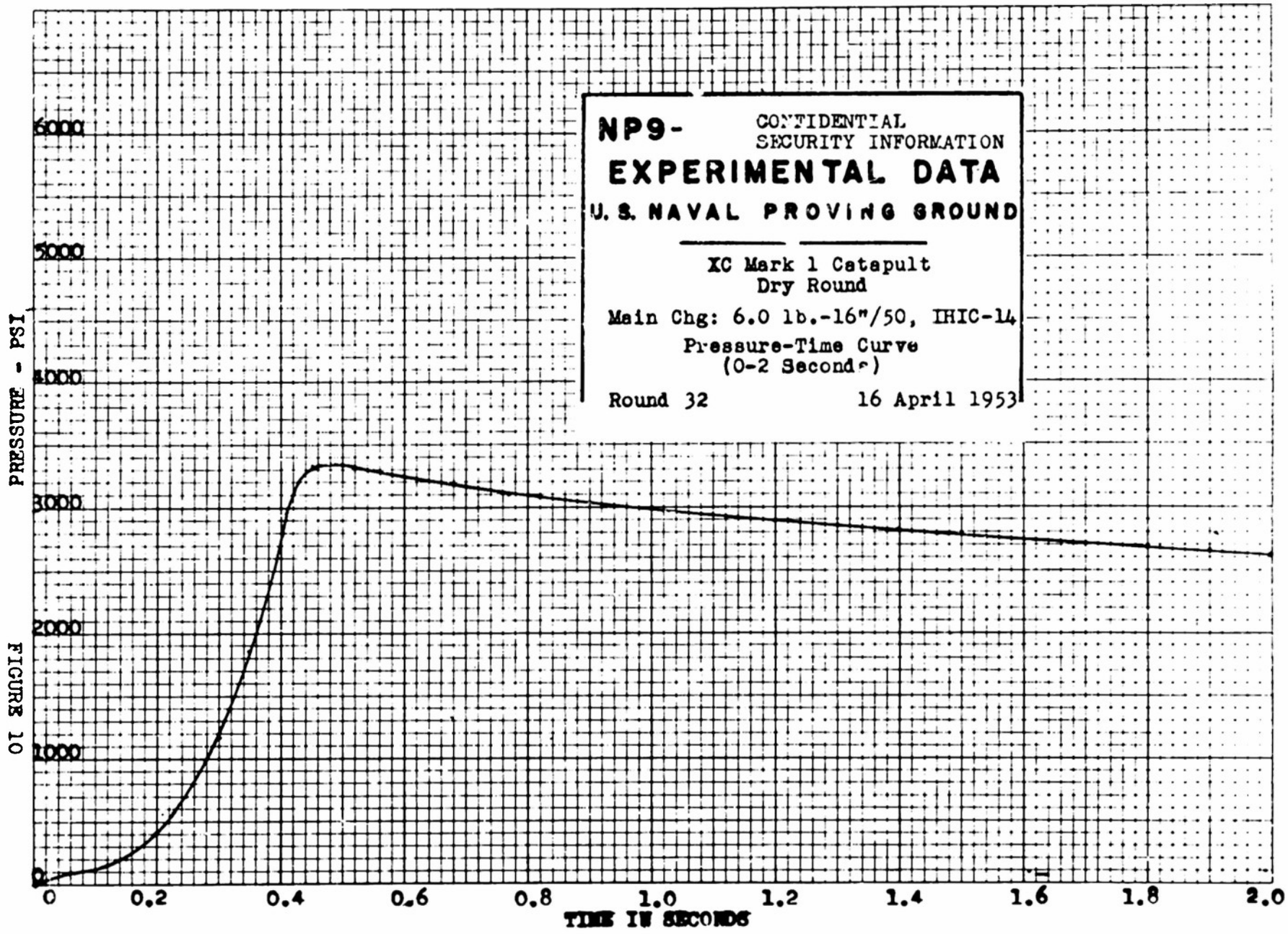

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Pressure-Time Curve
(0-2 Seconds)
Round 32
16 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 10

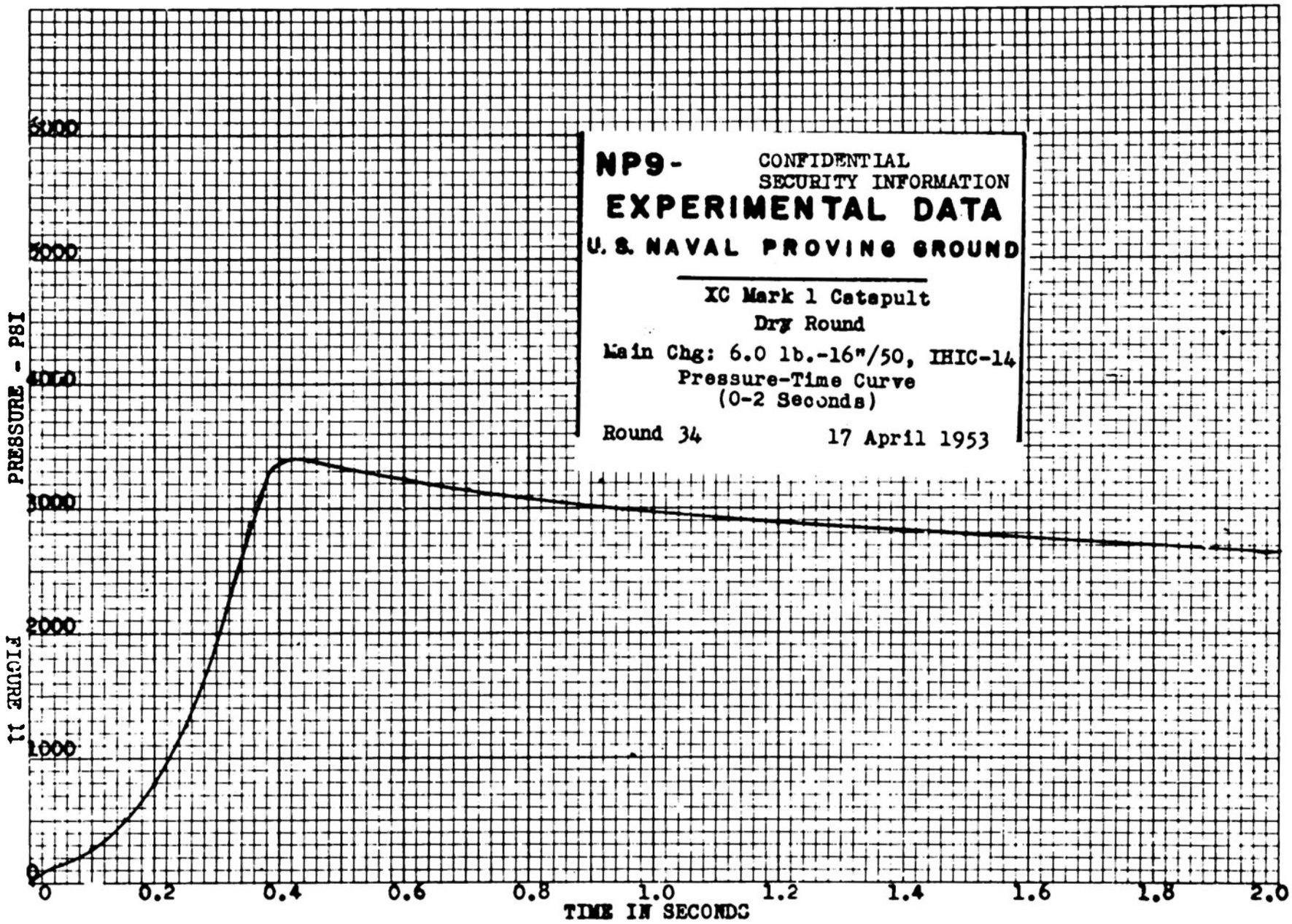

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Pressure-Time Curve
(0-2 Seconds)
Round 34
17 April 1953
PRESSURE - PSI
TIME IN SECONDS
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
1000
2000
3000
4000
5000

FIGURE 11

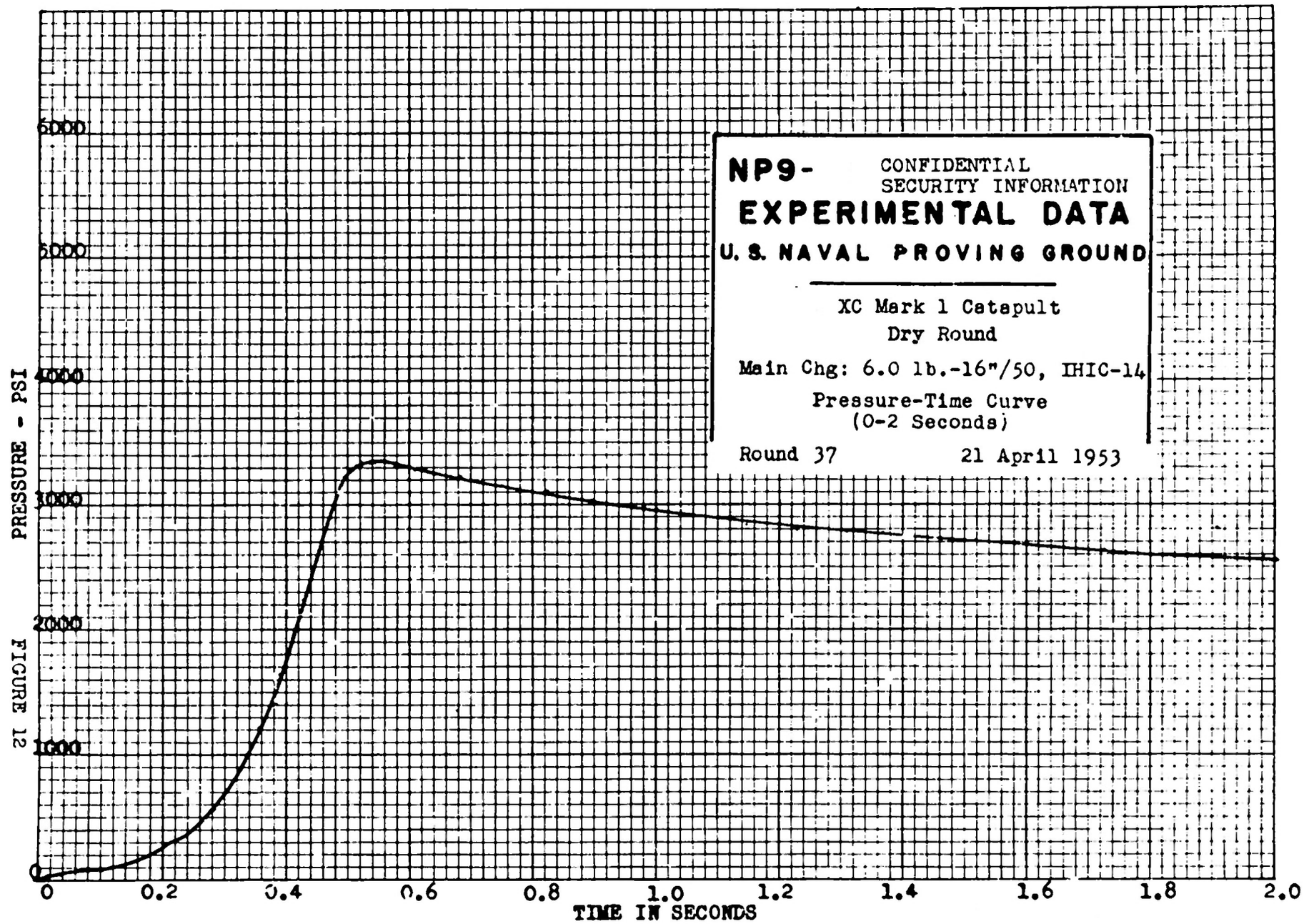

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Pressure-Time Curve
(0-2 Seconds)
Round 37
21 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 12

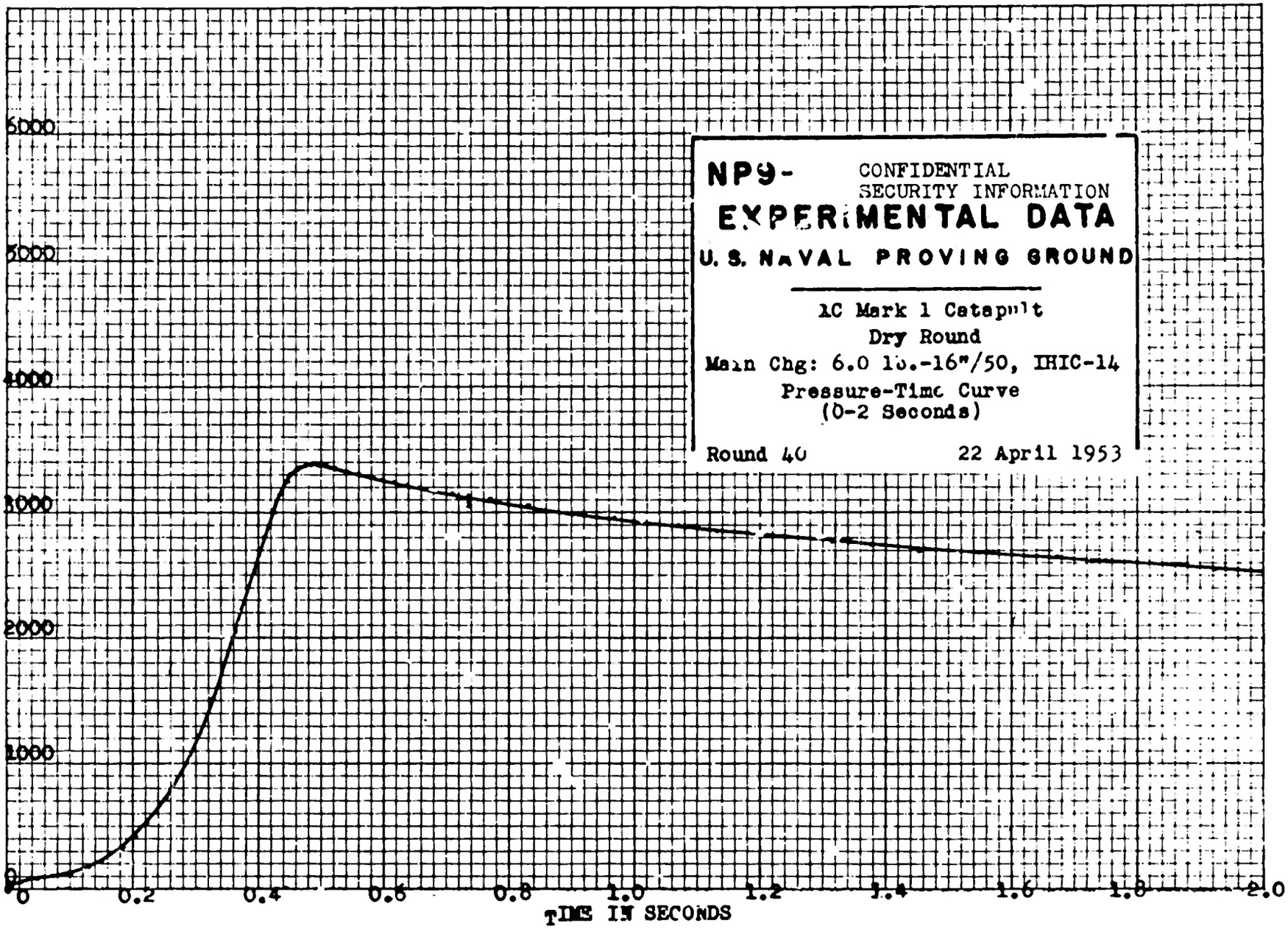
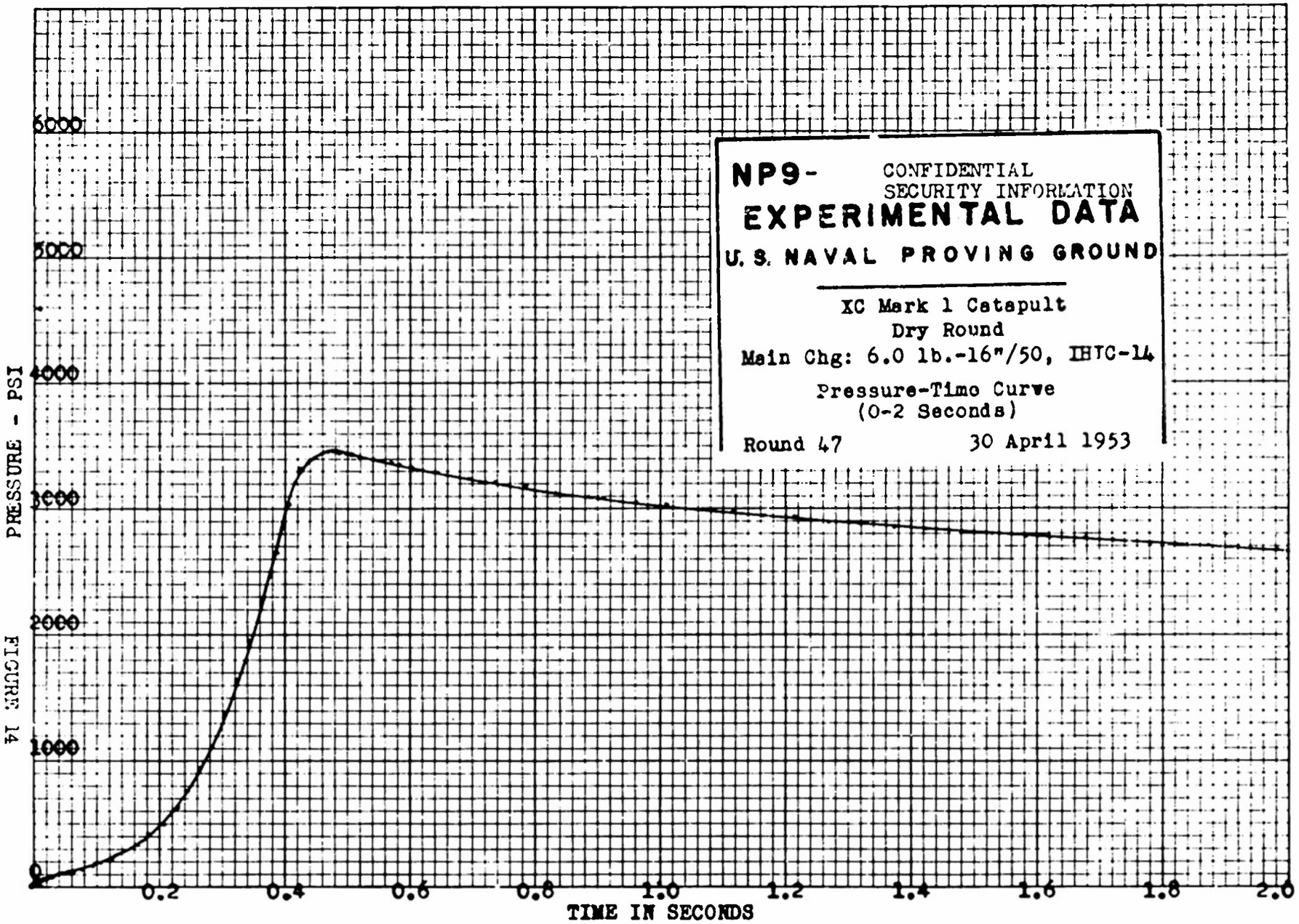

NPG-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
1C Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Pressure-Time Curve
(0-2 Seconds)
Round 40
22 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 13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CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHTC-14
Pressure-Time Curve
(0-2 Seconds)
Round 47
30 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 14

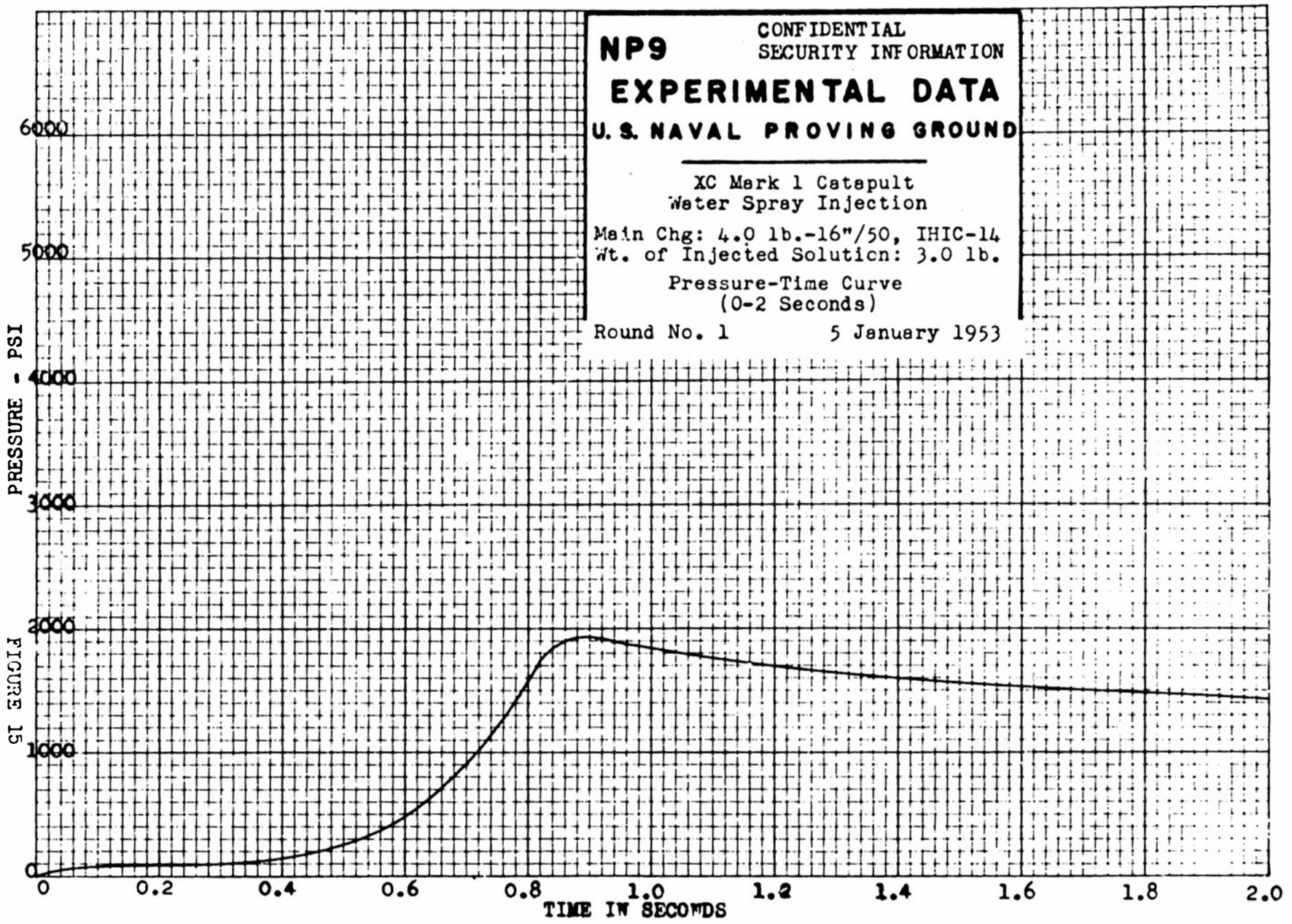
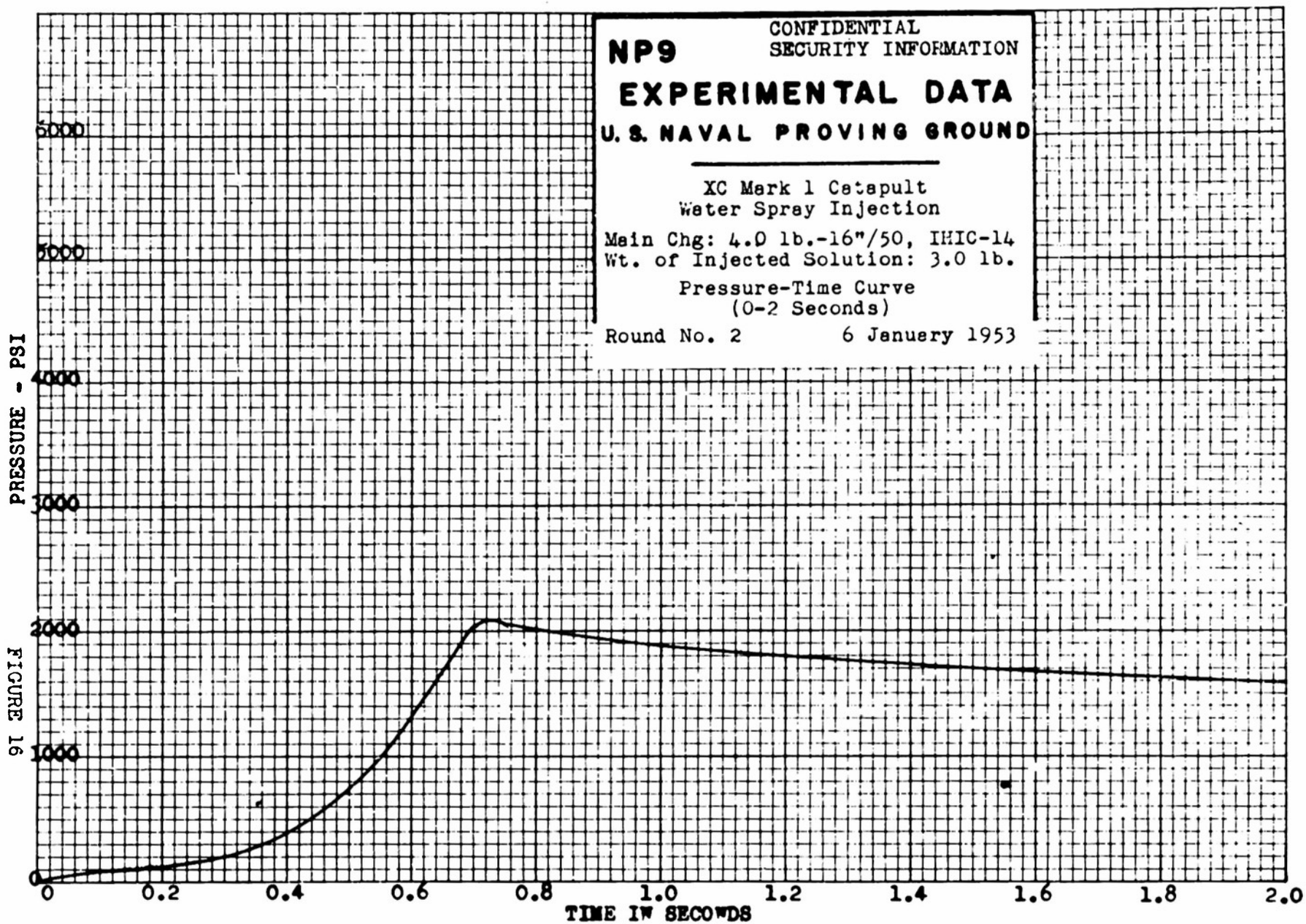

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 4.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 1
5 January 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 15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SECURITY INFORMATION
NP9
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 4.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 2 6 January 1953
PRESSURE - PSI
5000
4000
3000
2000
1000
0
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
TIME IN SECONDS

FIGURE 16

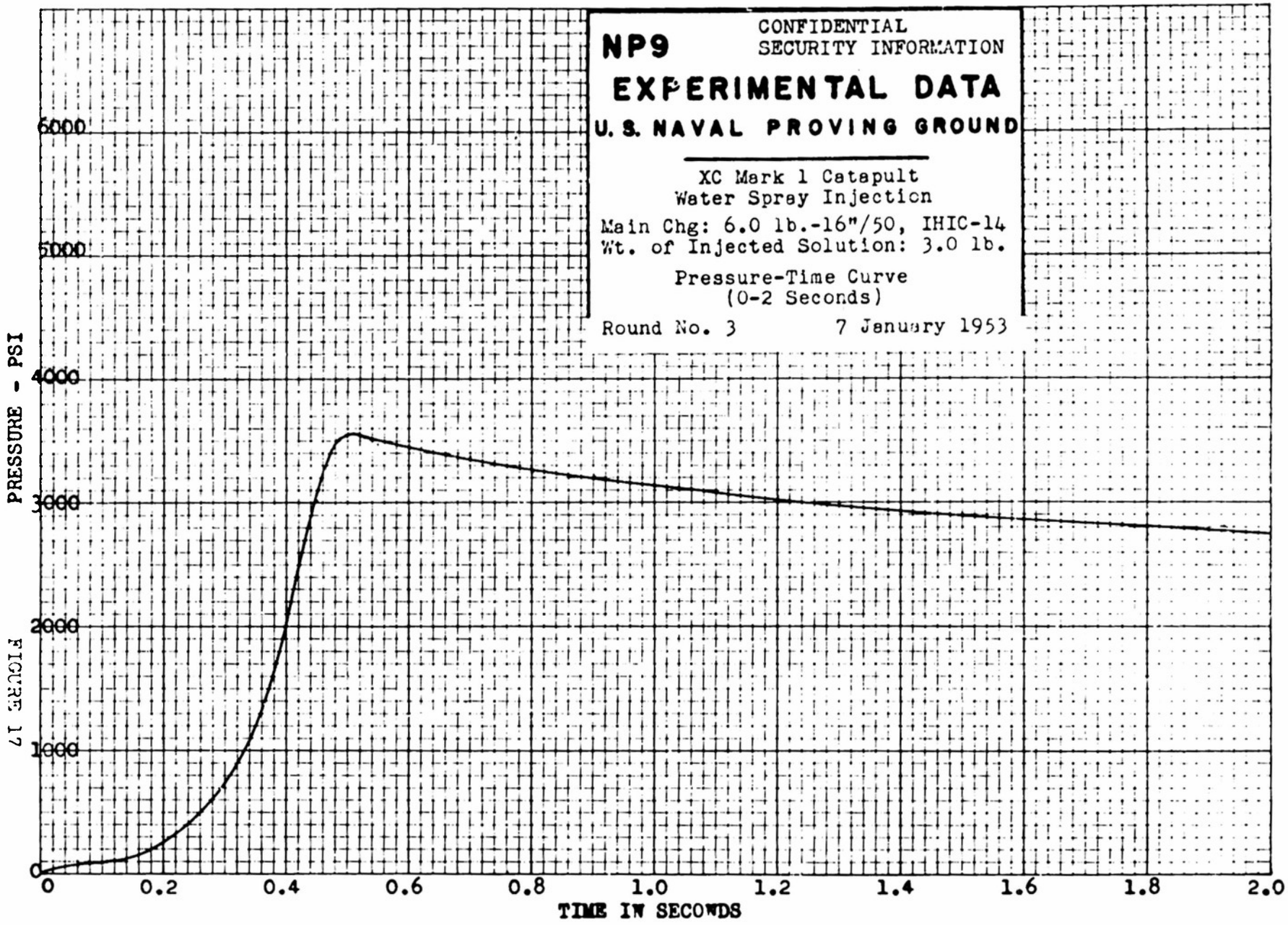

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 3
7 January 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 17

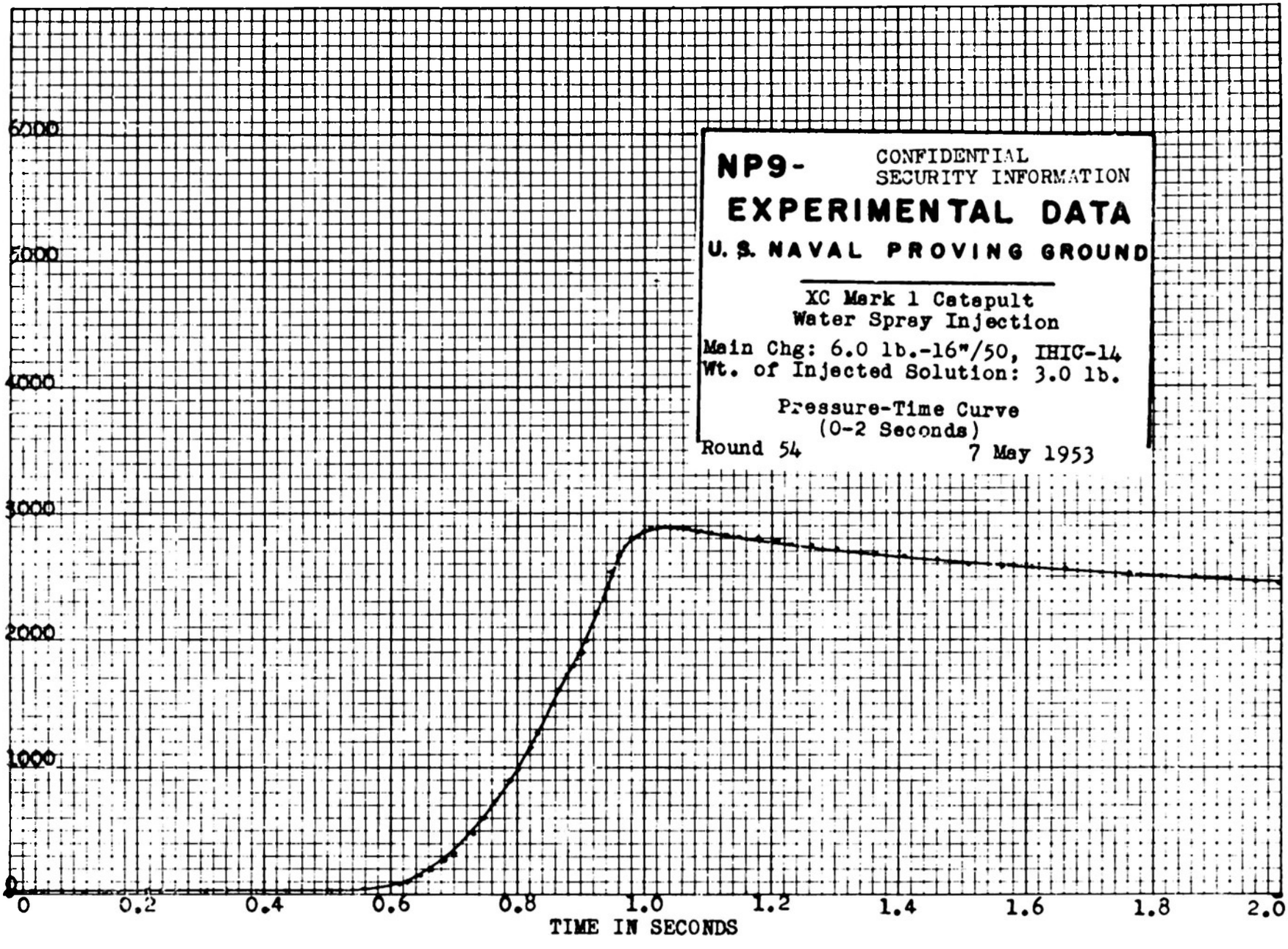

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 54
7 May 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 18

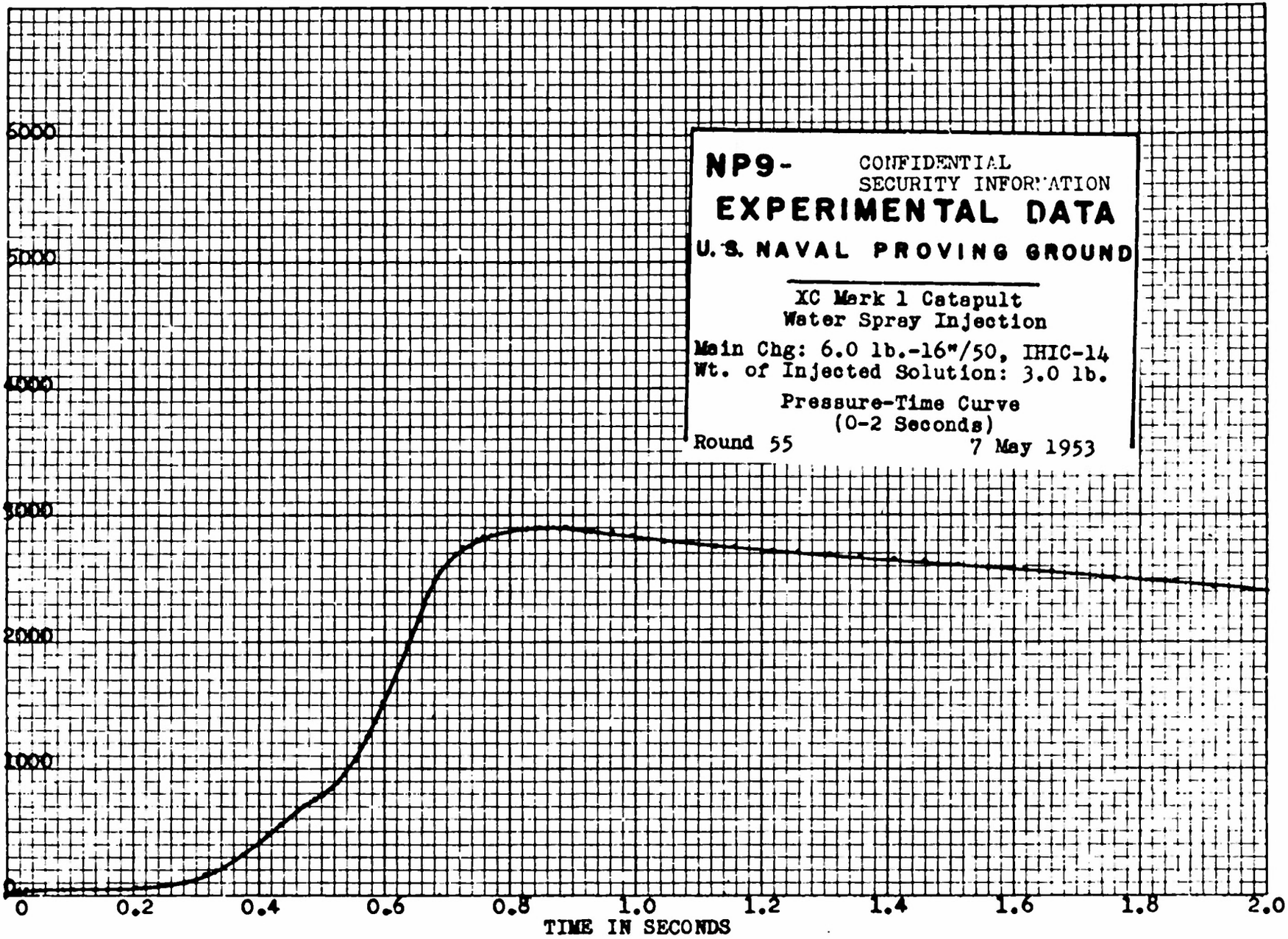
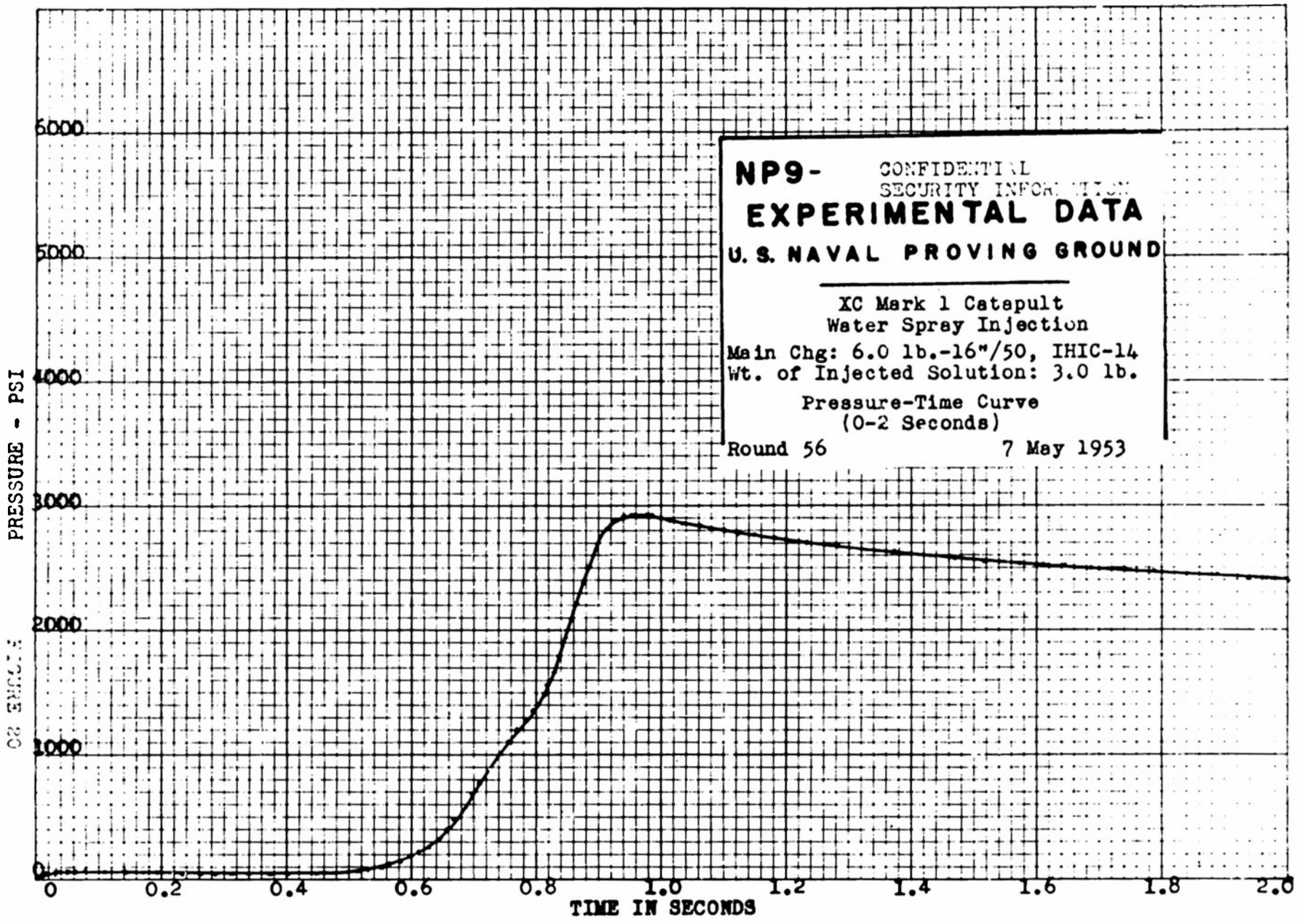

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 55
7 May 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 19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SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 56
7 May 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 20

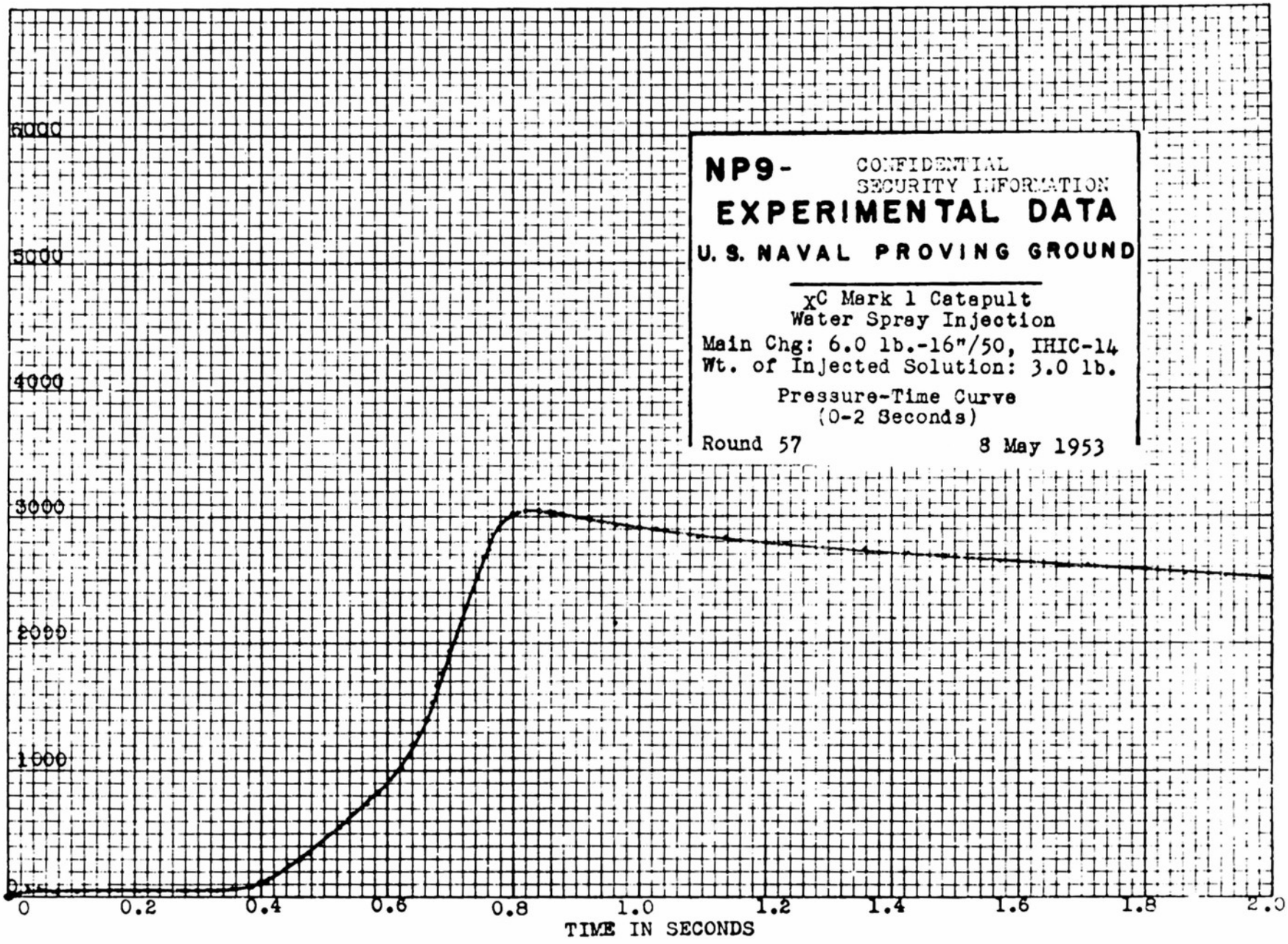

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 57
8 May 1953
PRESSURE - PSI
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 21

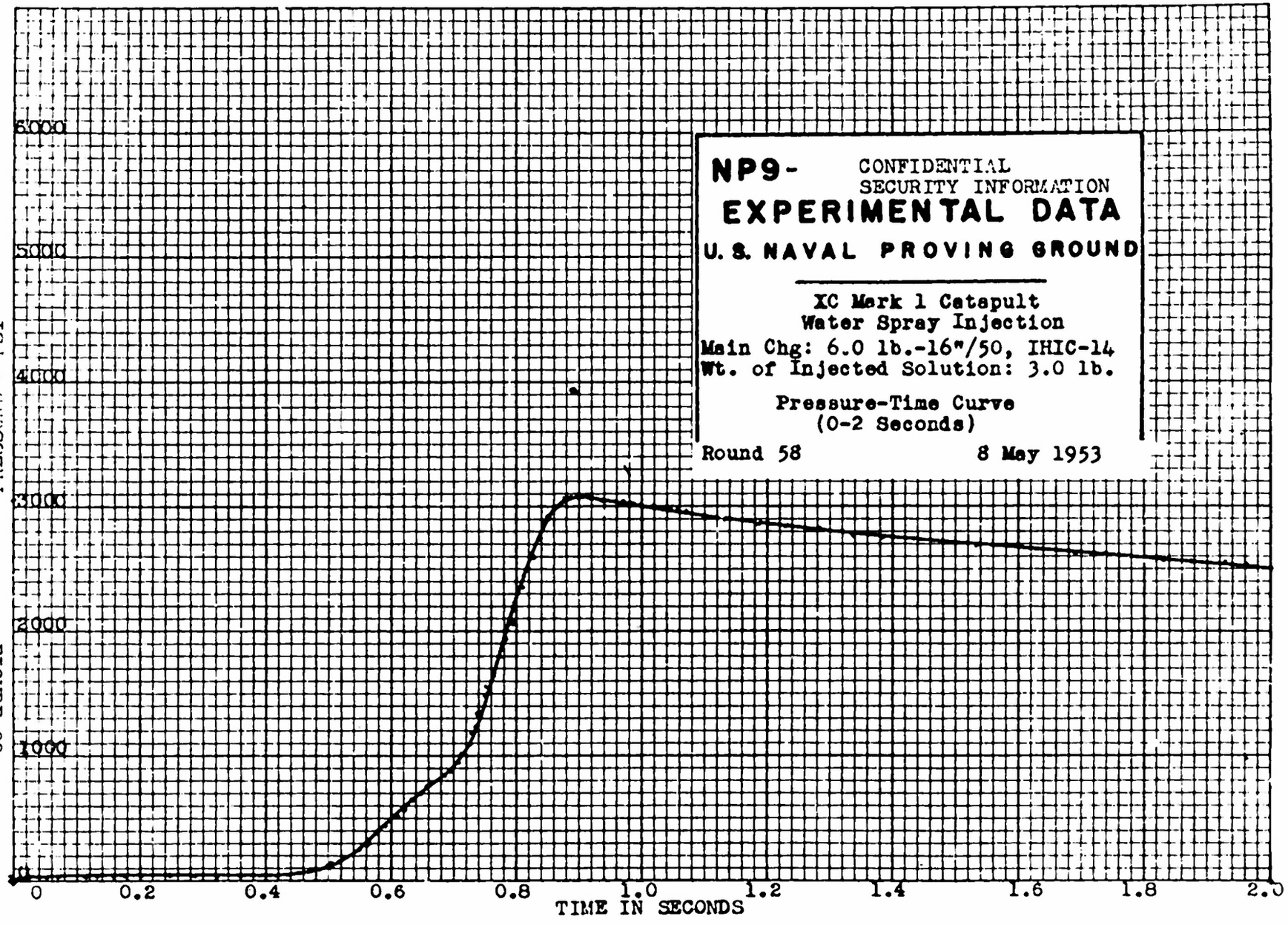

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 58
8 May 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 22

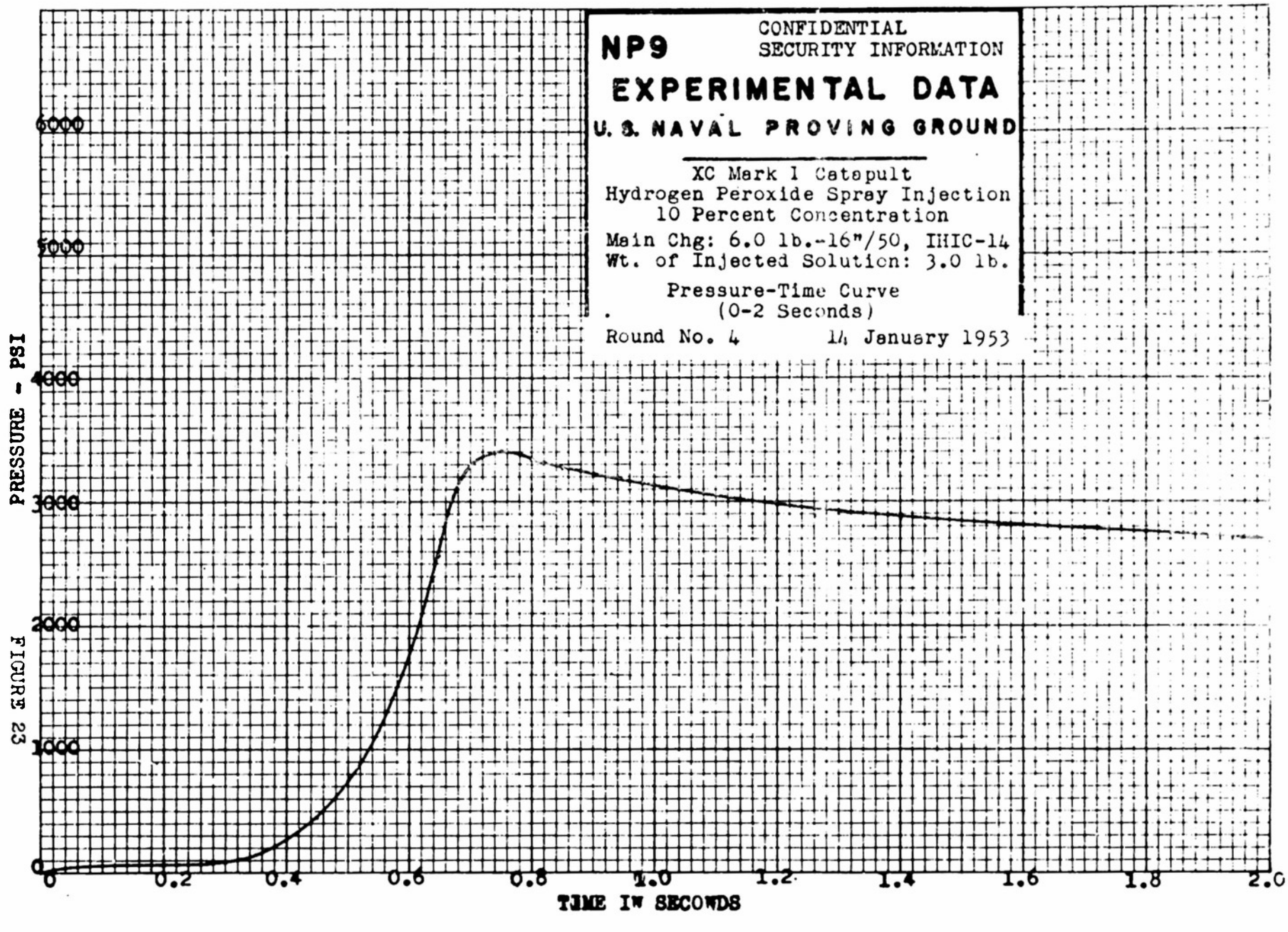

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 4
14 January 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 23

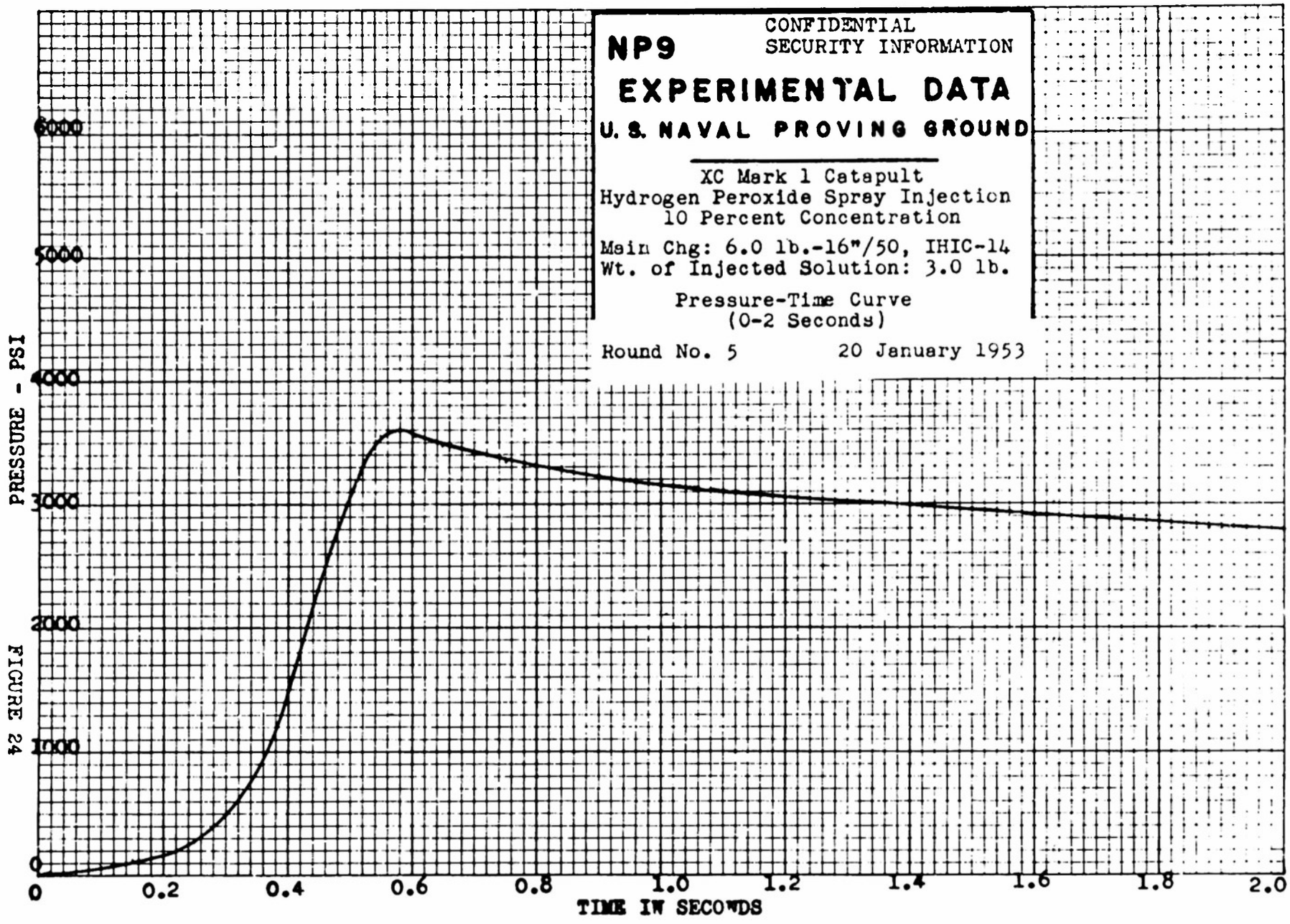

CONFIDENTIAL
SECURITY INFORMATION
NP9
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 5
20 January 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 24

CONFIDENTIAL
SECURITY INFORMATION

NP9

EXPERIMENTAL DATA

U. S. NAVAL PROVING GROUND

XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration

Main Chg: 6.0 lb.-16"/50, IMR-14
Wt. of Injected Solution: 3.0 lb.

Pressure-Time Curve
(0-2 Seconds)

Round No. 6 22 January 1953

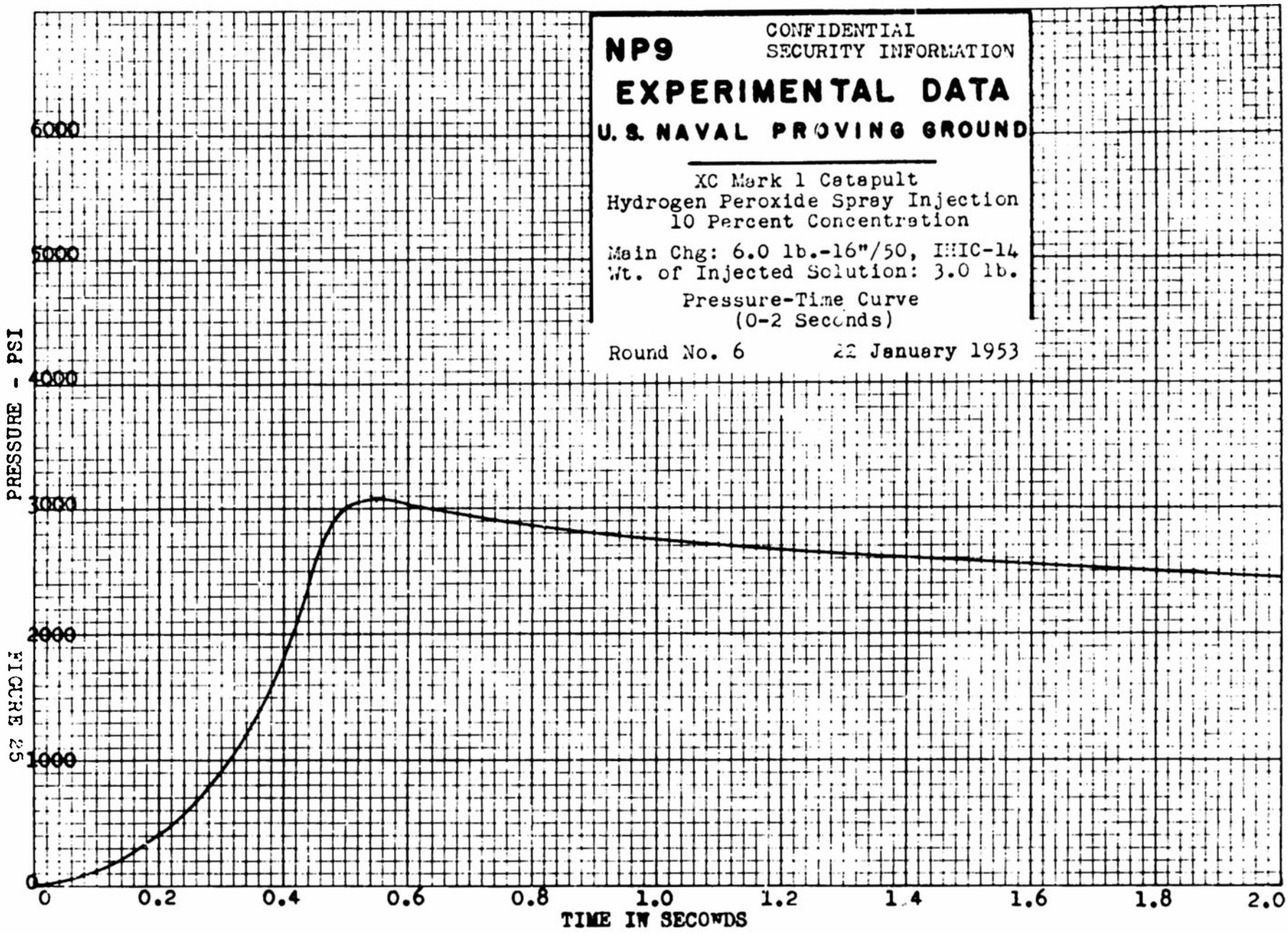


FIGURE 25

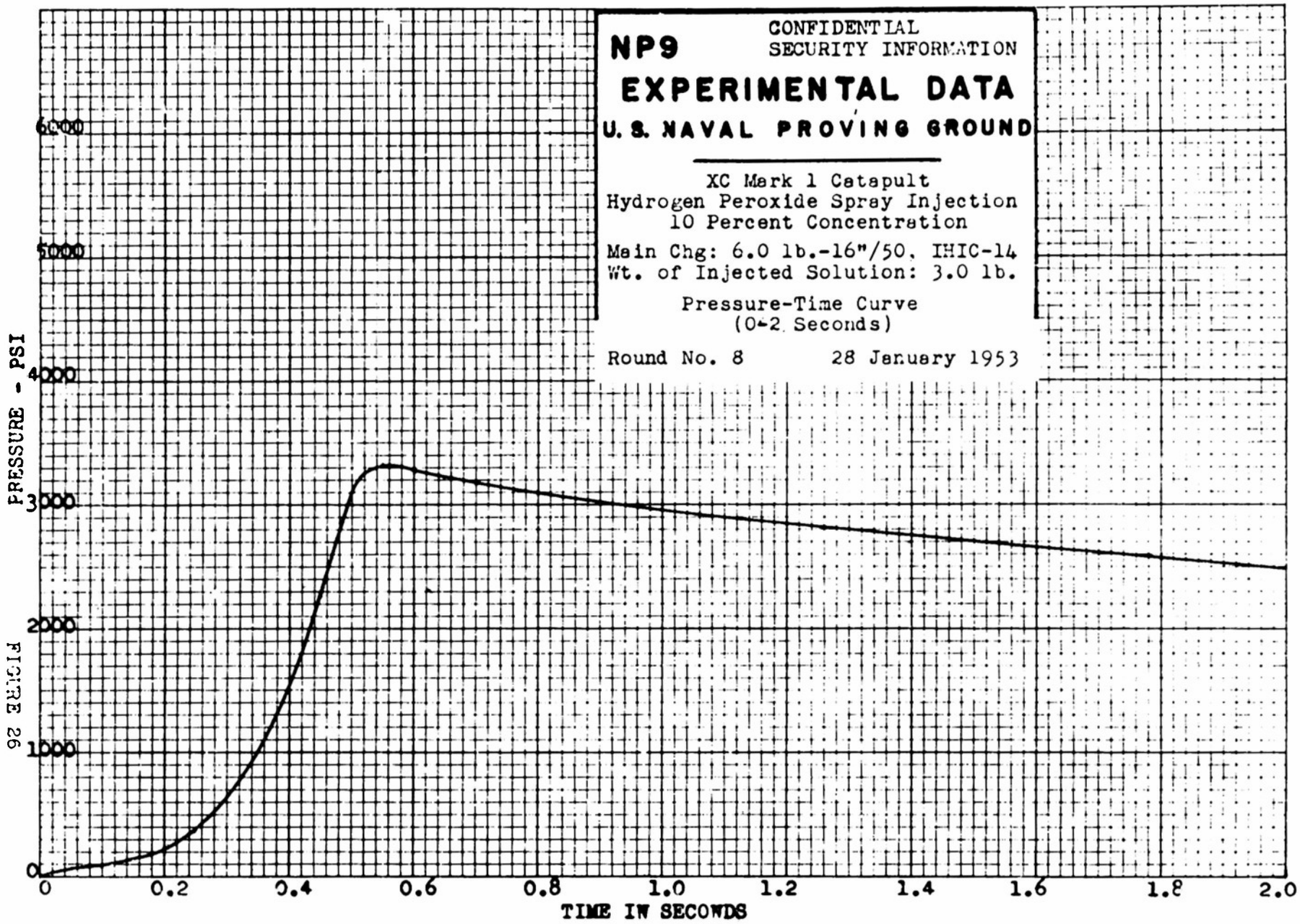

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 8
28 January 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 26

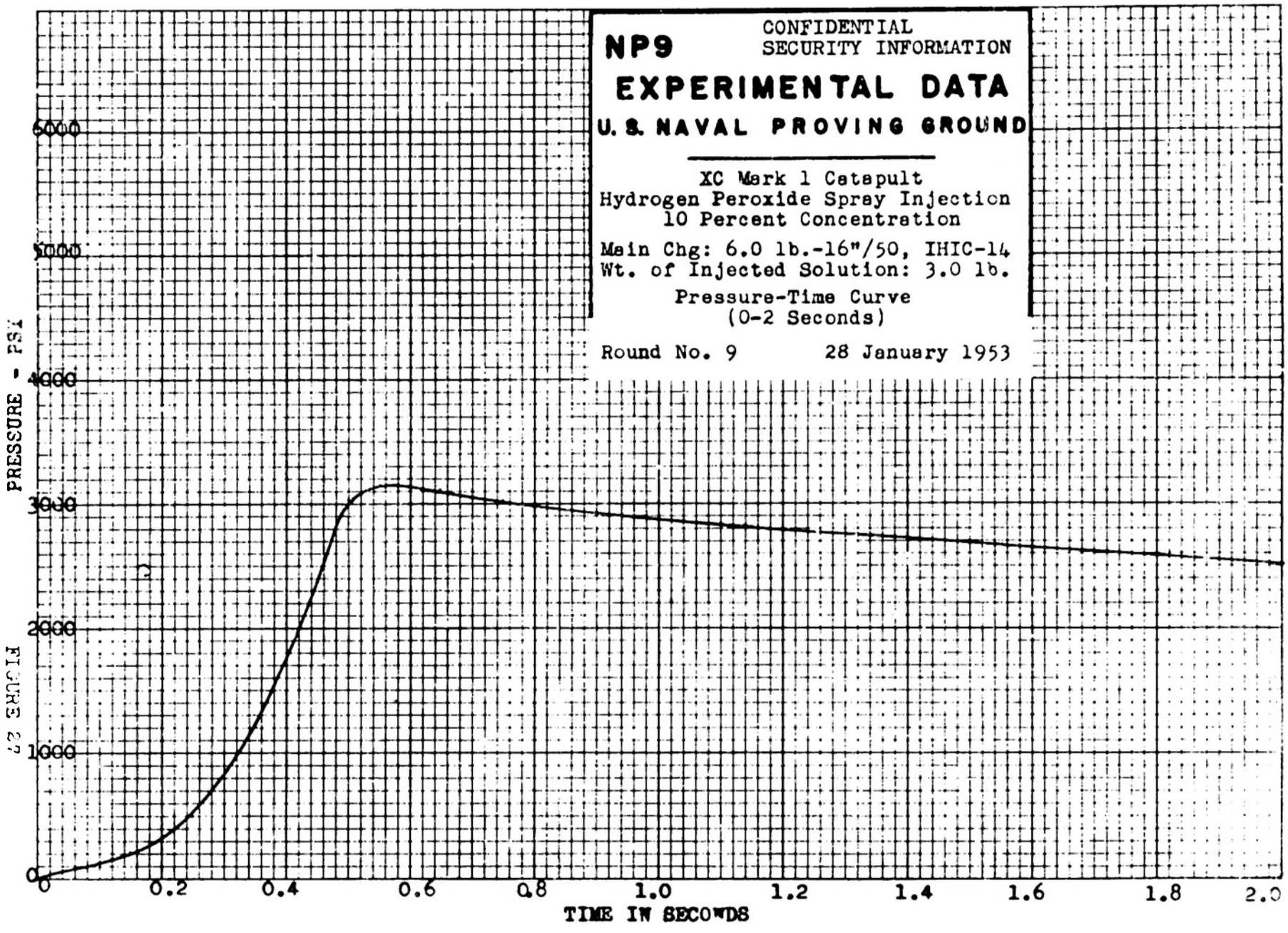
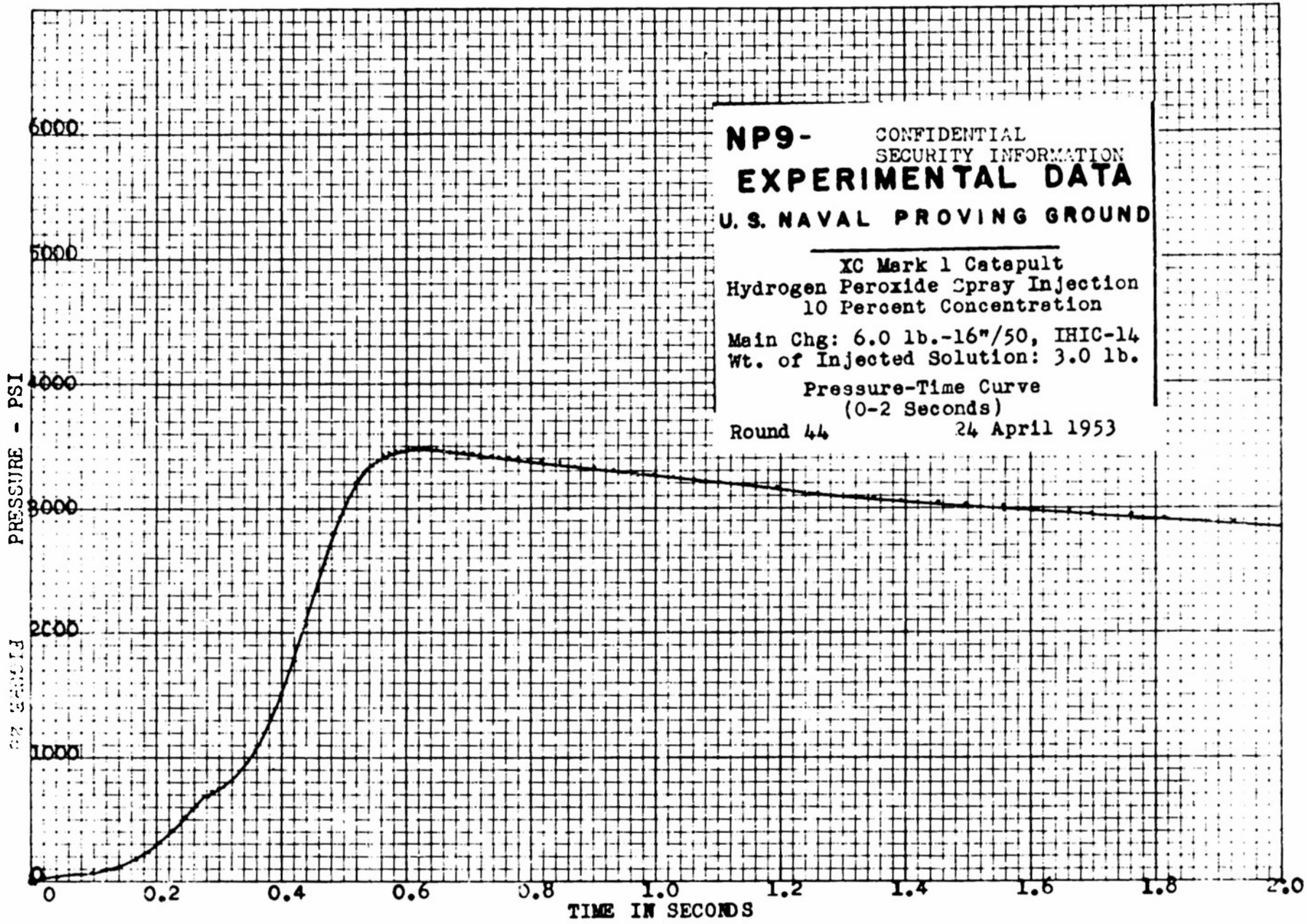

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 9 28 January 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 27


NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 44
24 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

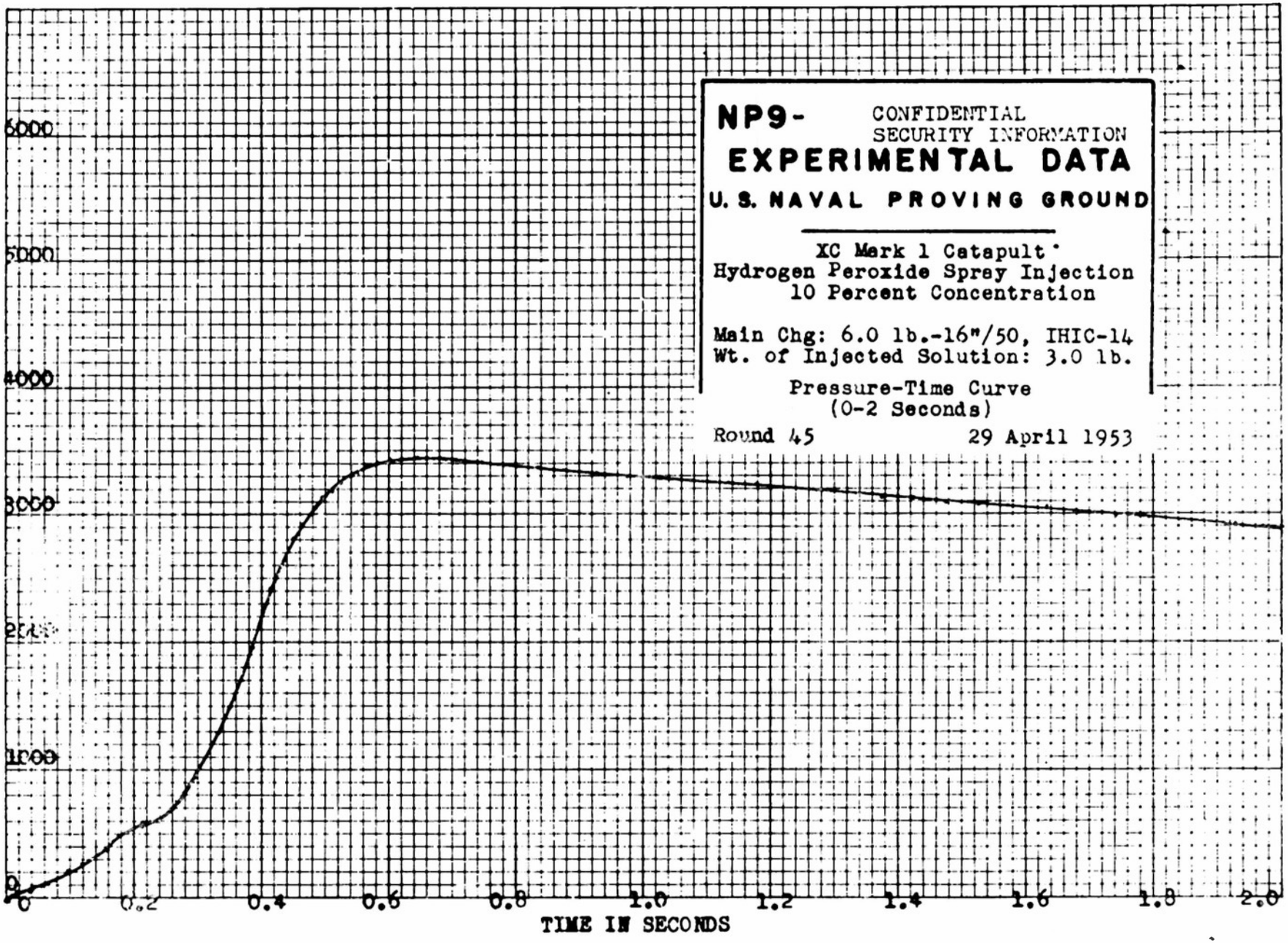

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 45
29 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 29

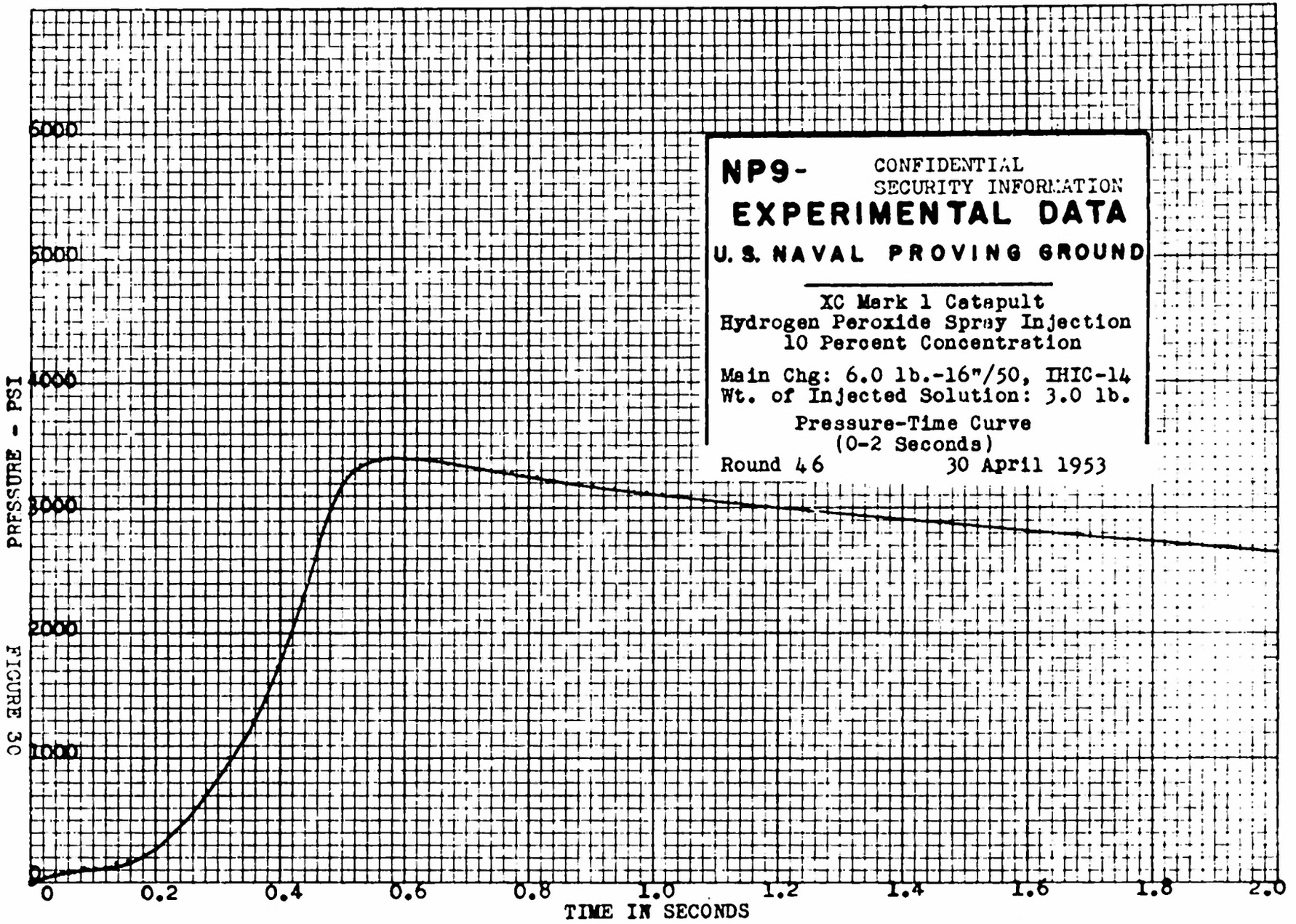

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 46
30 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 30

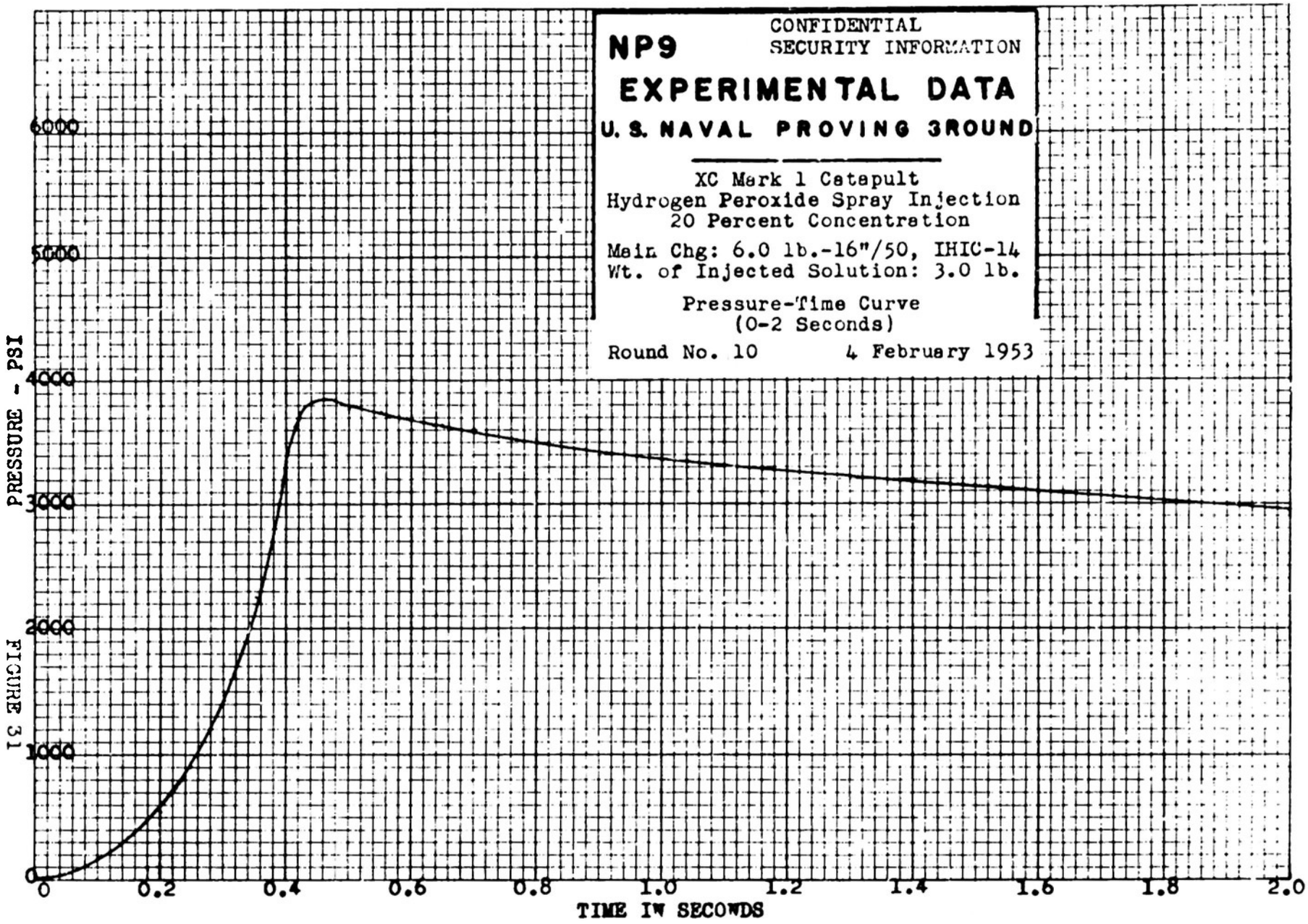

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 10
4 February 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 31

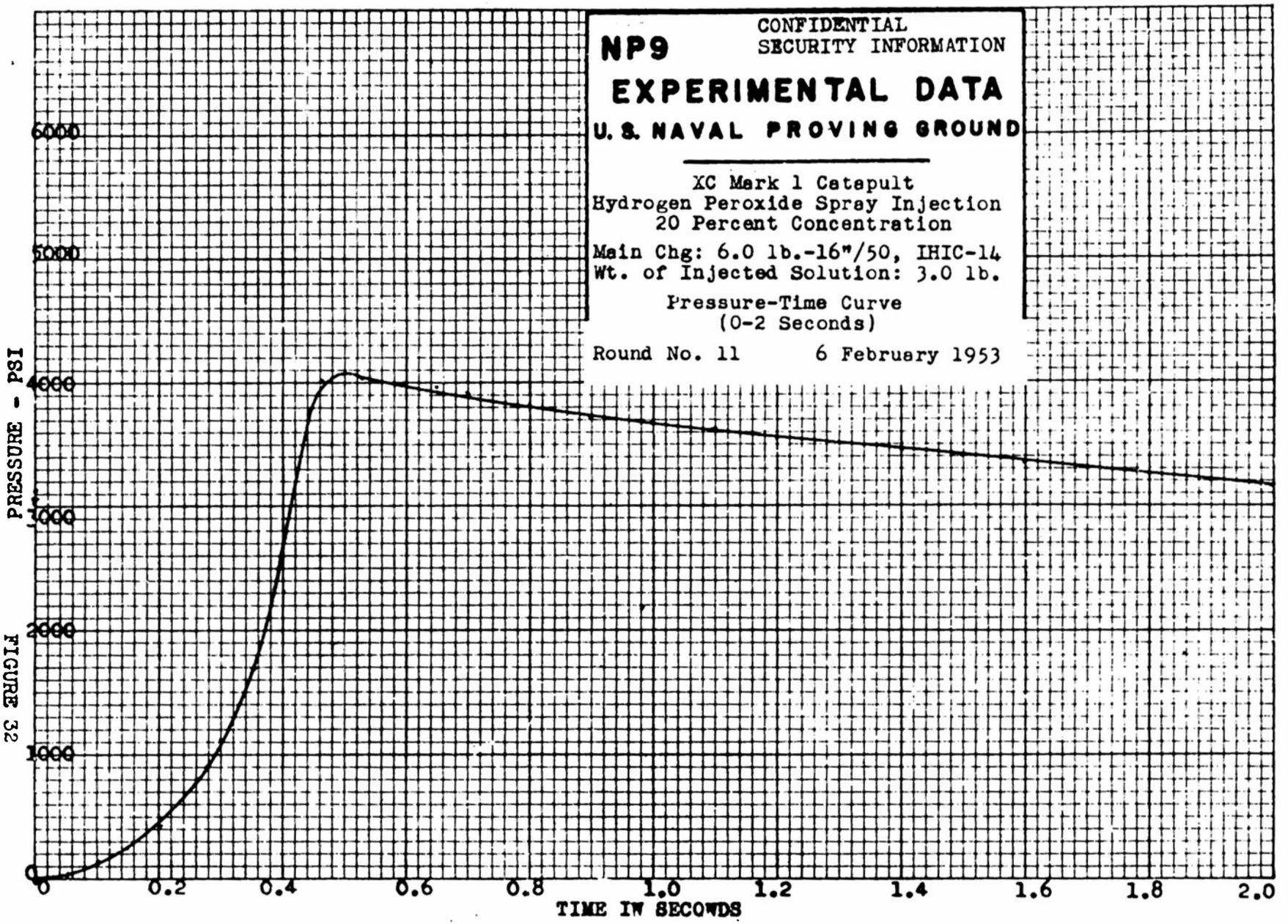

CONFIDENTIAL
SECURITY INFORMATION
NP9
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 11 6 February 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
TIME IN SECONDS

FIGURE 32

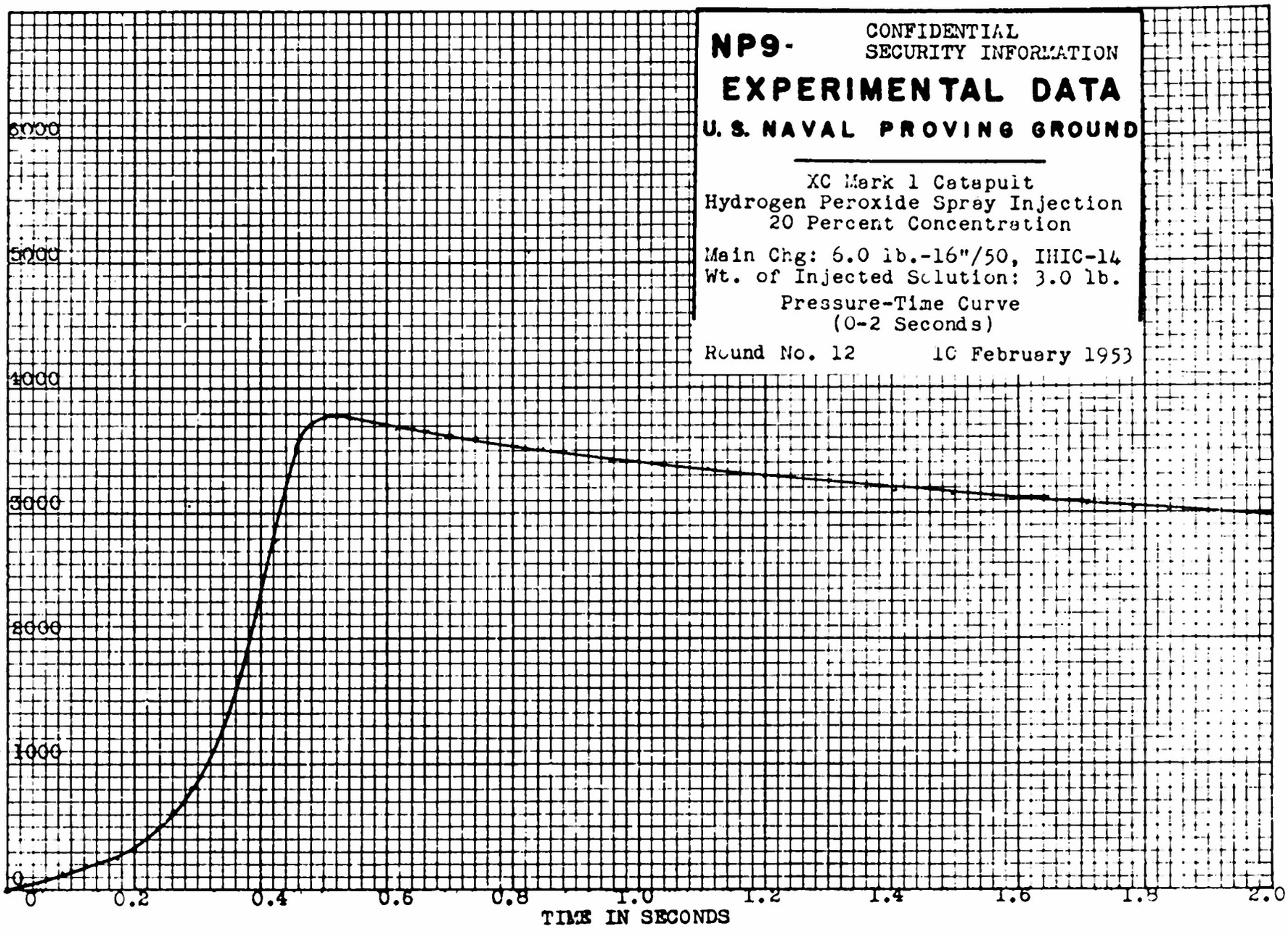

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 12
10 February 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 33

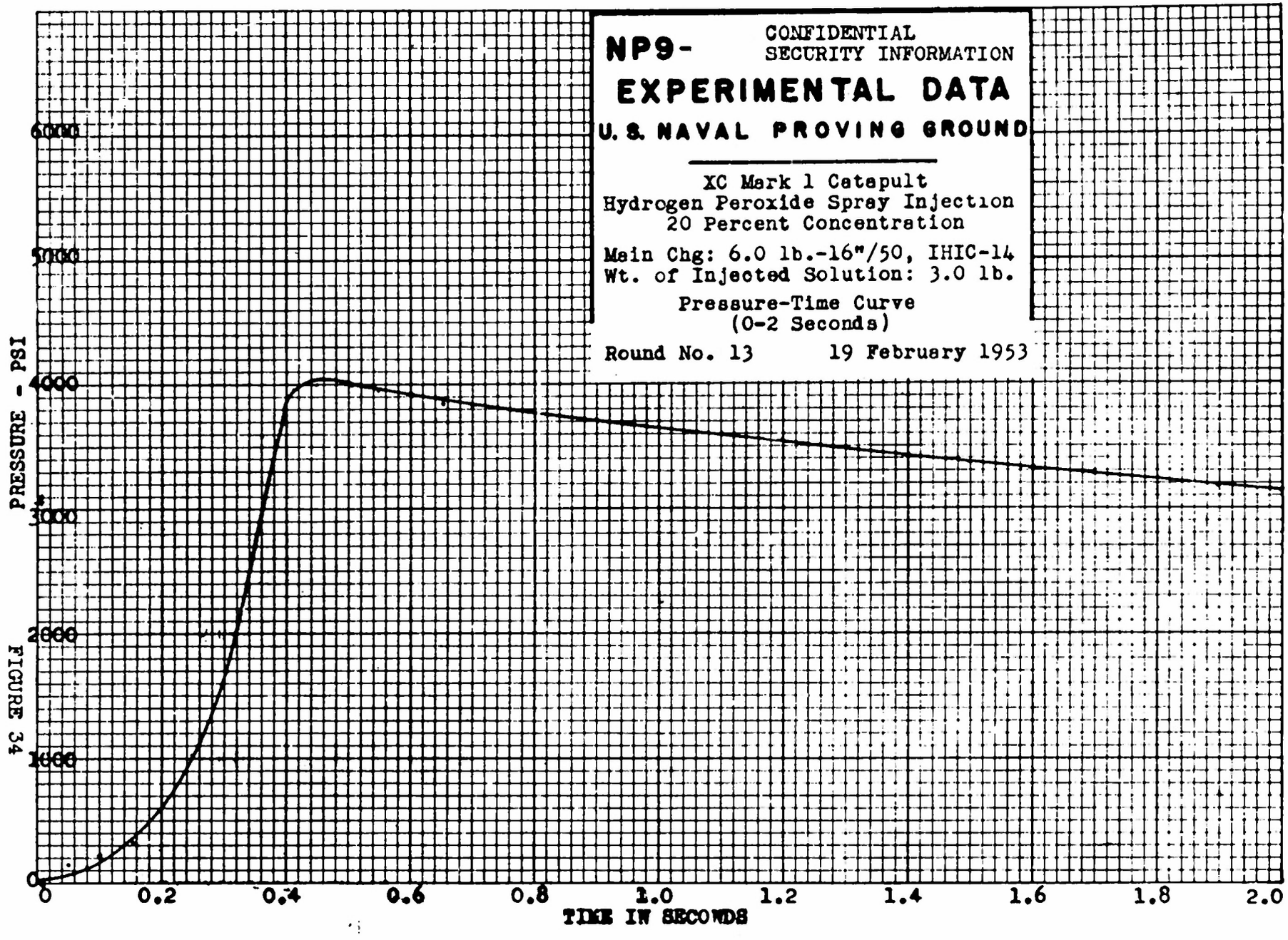
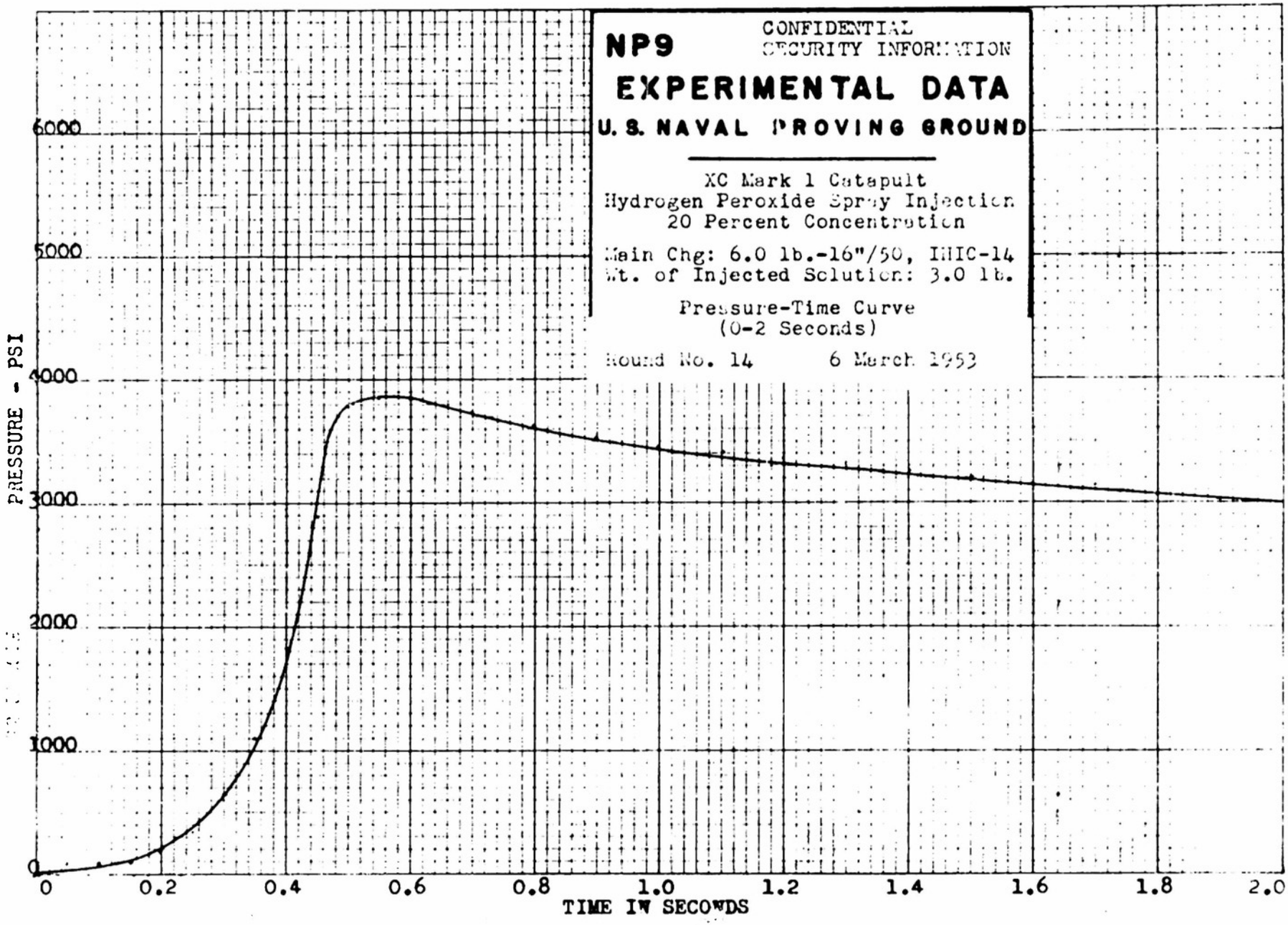

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 13 19 February 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
TIME IN SECONDS

FIGURE 34


NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IMR-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 14
6 March 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

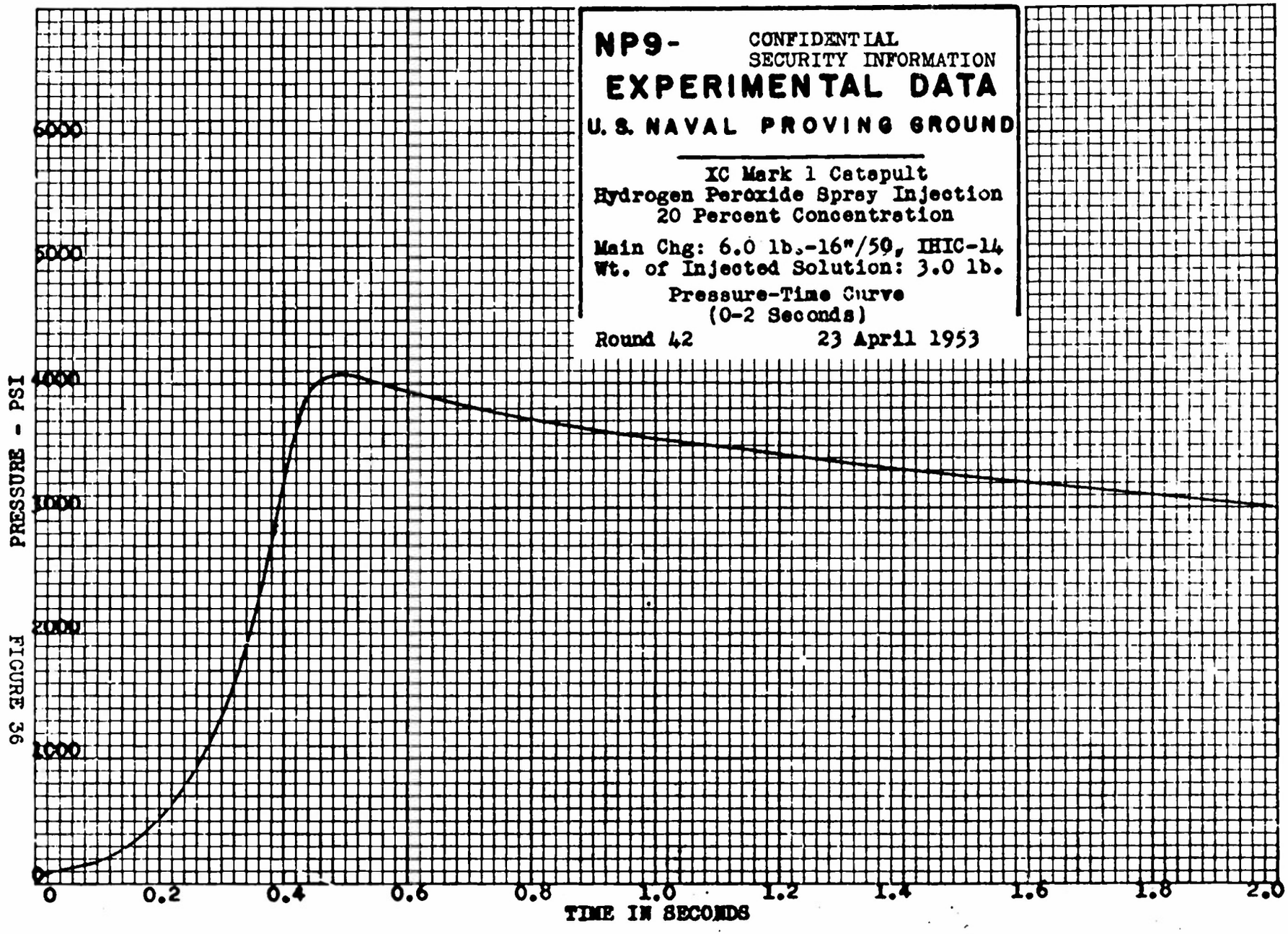

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 42
23 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 36

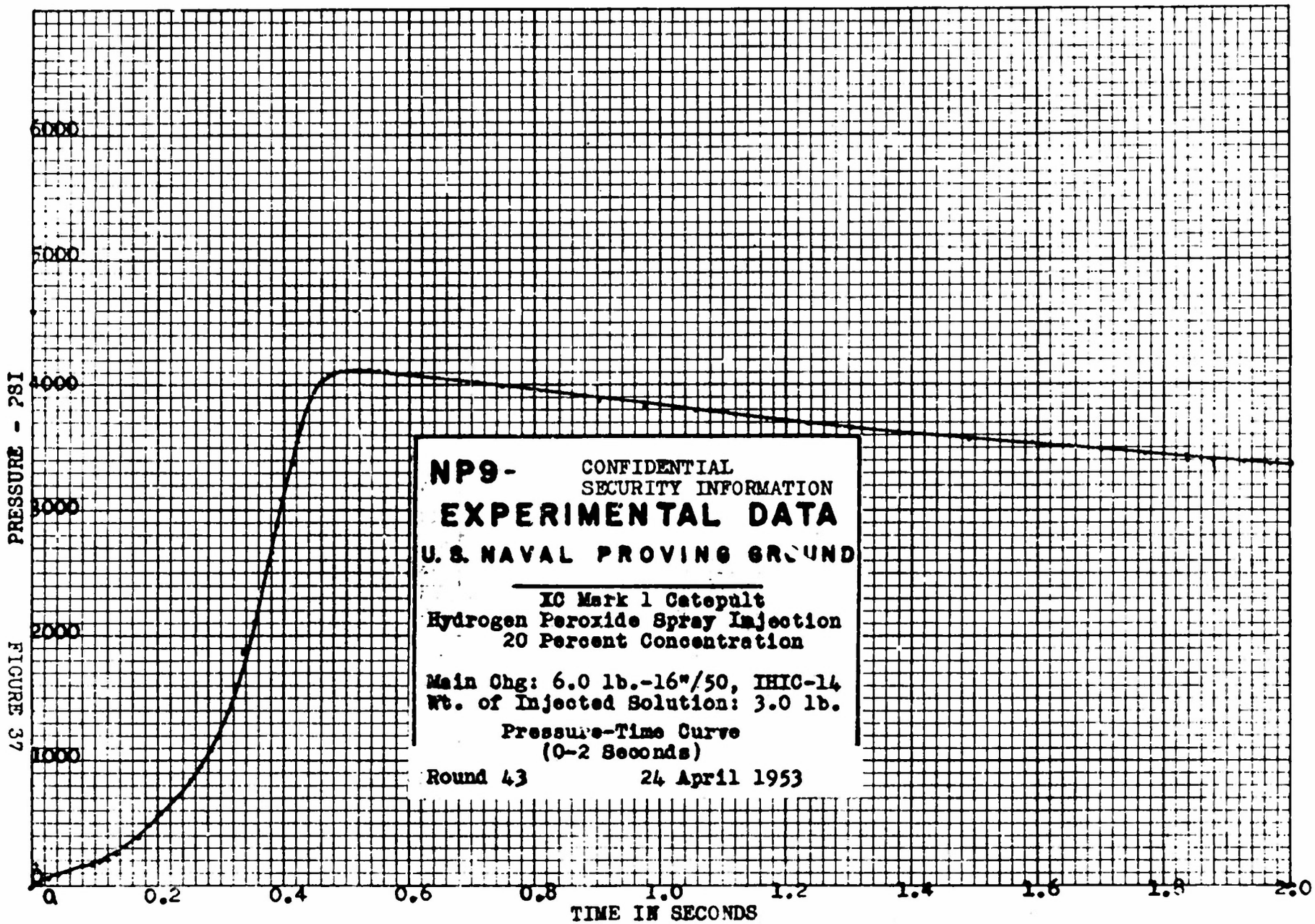

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 43 24 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 37

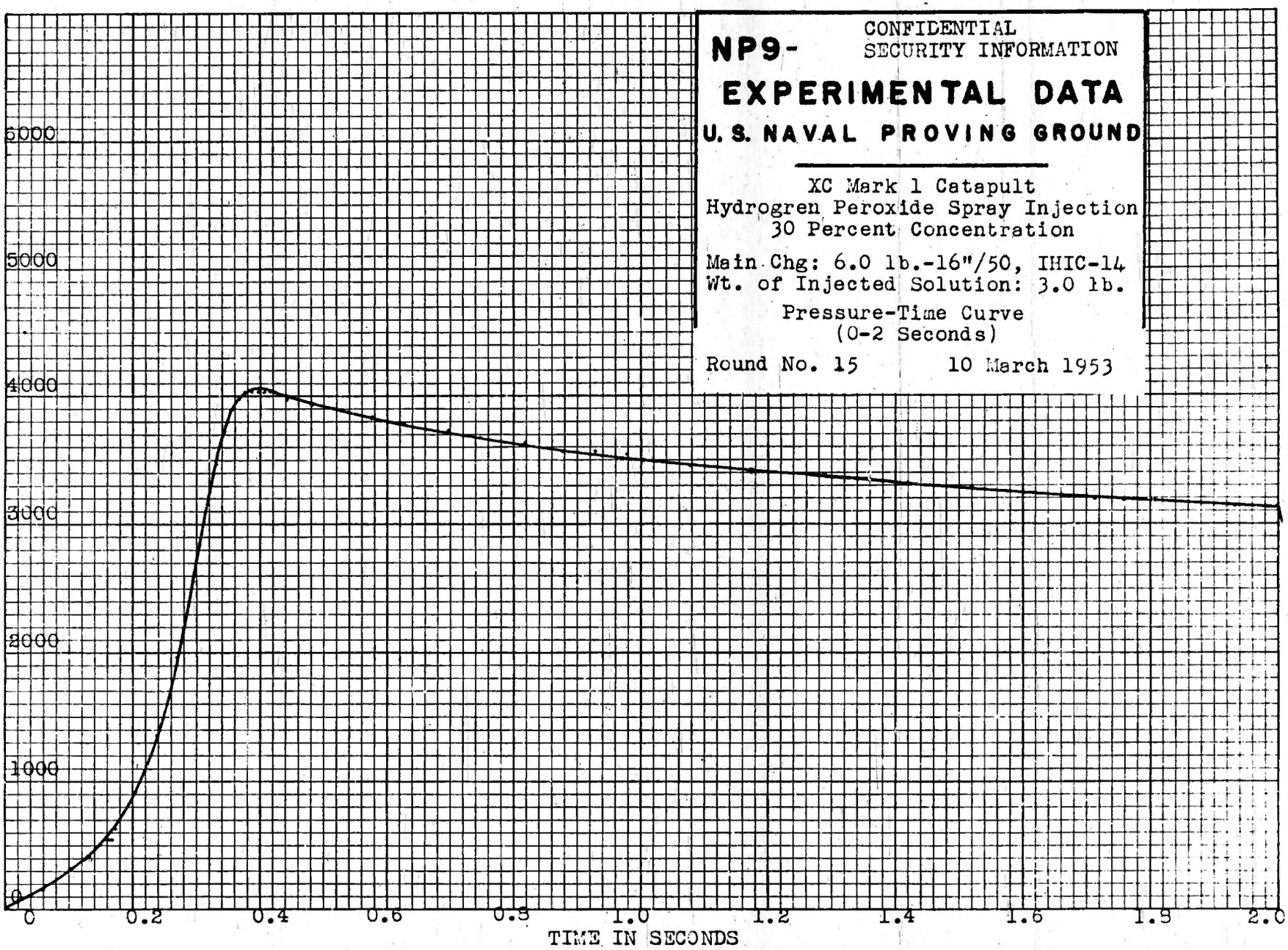

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogren Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 15
10 March 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 38

CONFIDENTIAL
SECURITY INFORMATION

NP9-

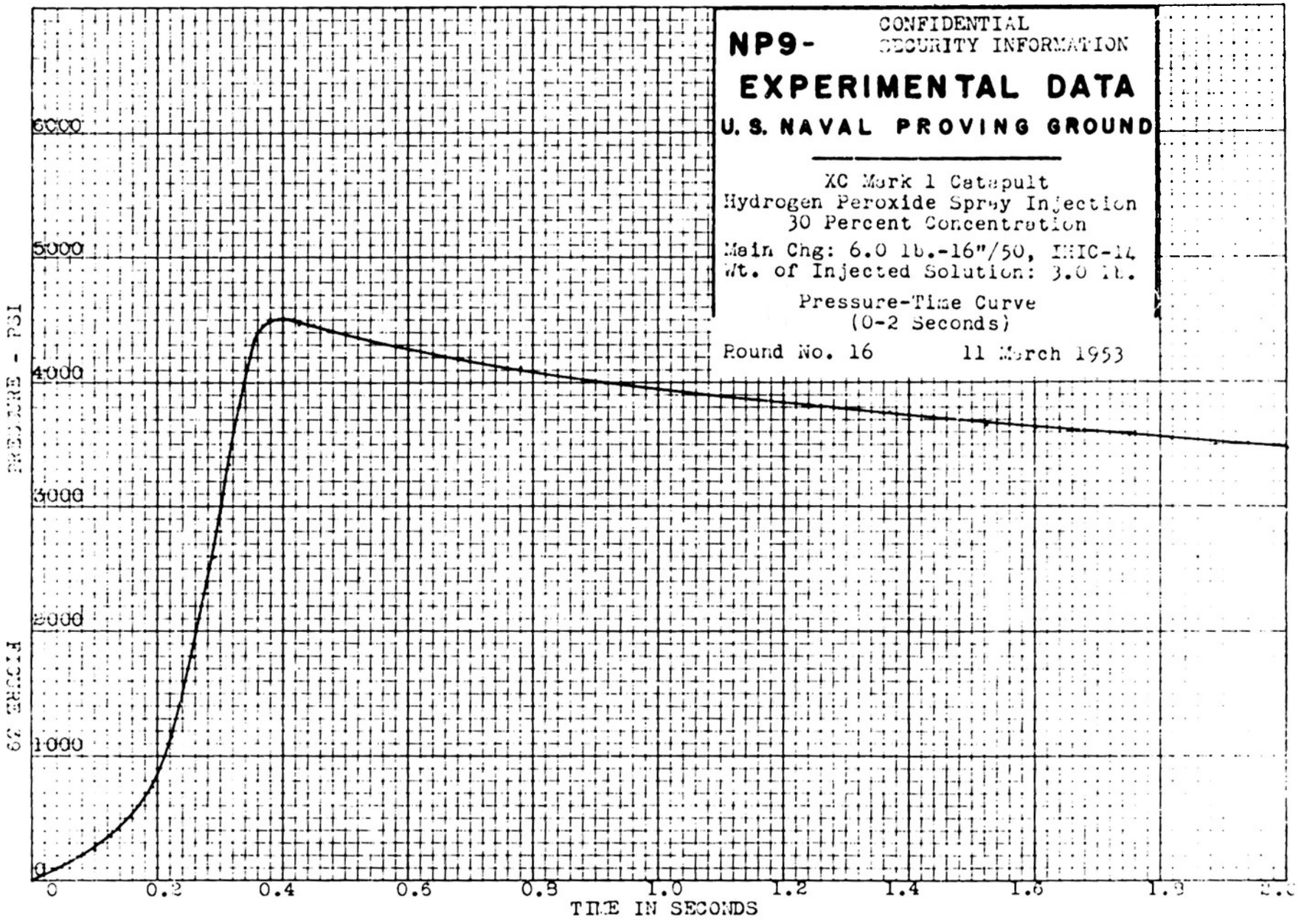
EXPERIMENTAL DATA

U. S. NAVAL PROVING GROUND

XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IMR-14
Wt. of Injected Solution: 3.0 lb.

Pressure-Time Curve
(0-2 Seconds)

Round No. 16 11 March 1953



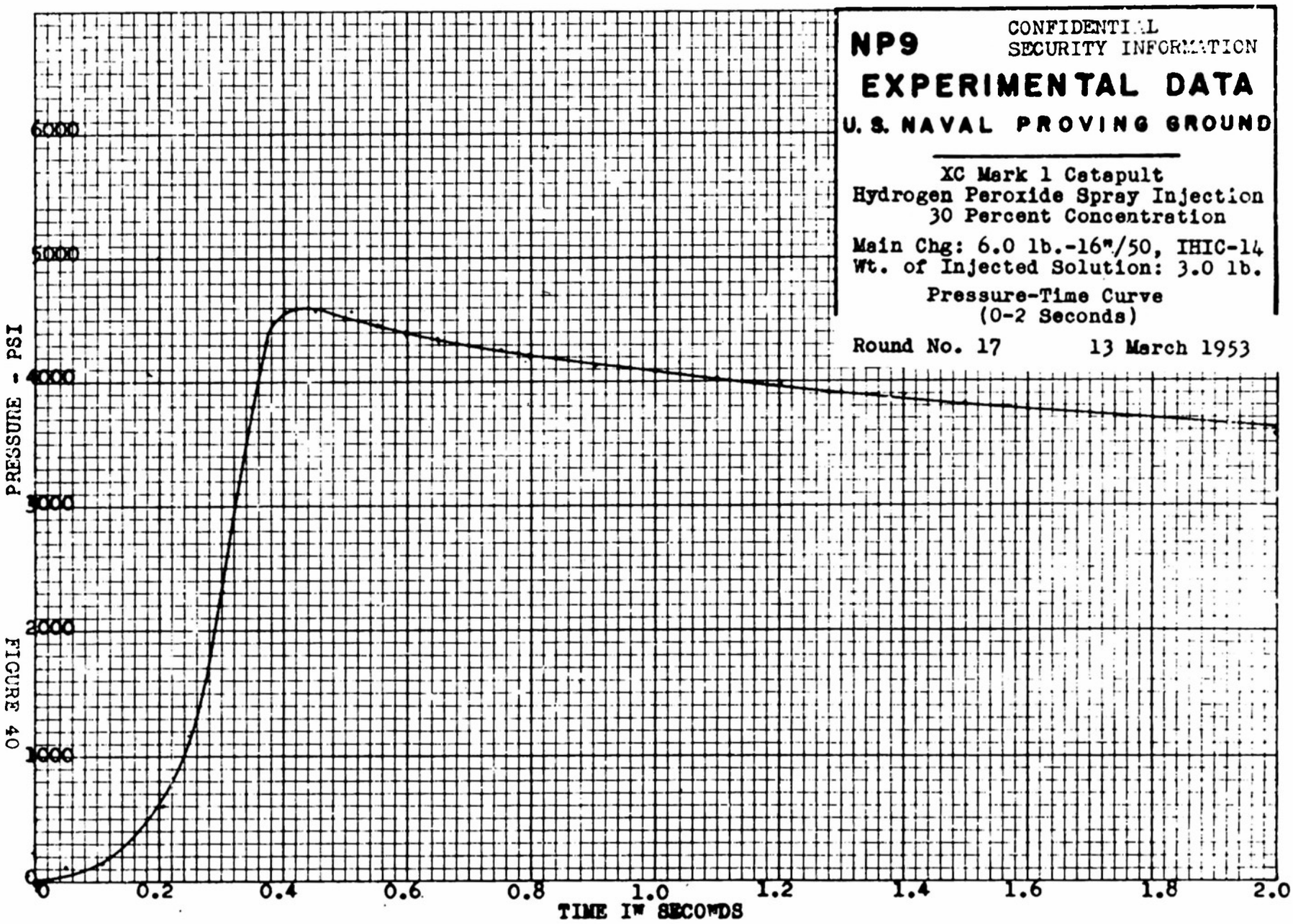

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 17
13 March 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 40

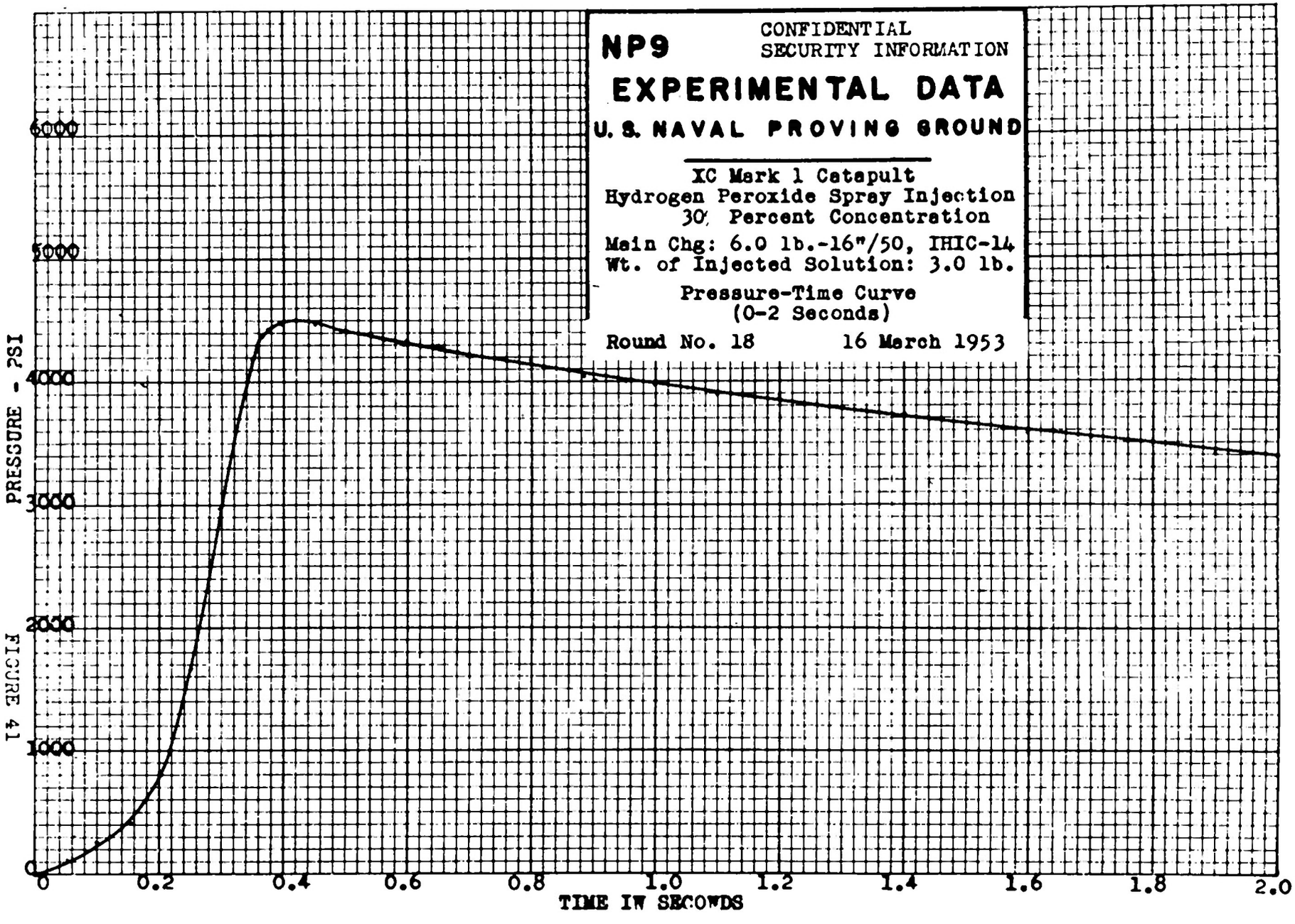

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30% Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 18 16 March 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
TIME IN SECONDS

FIGURE 41

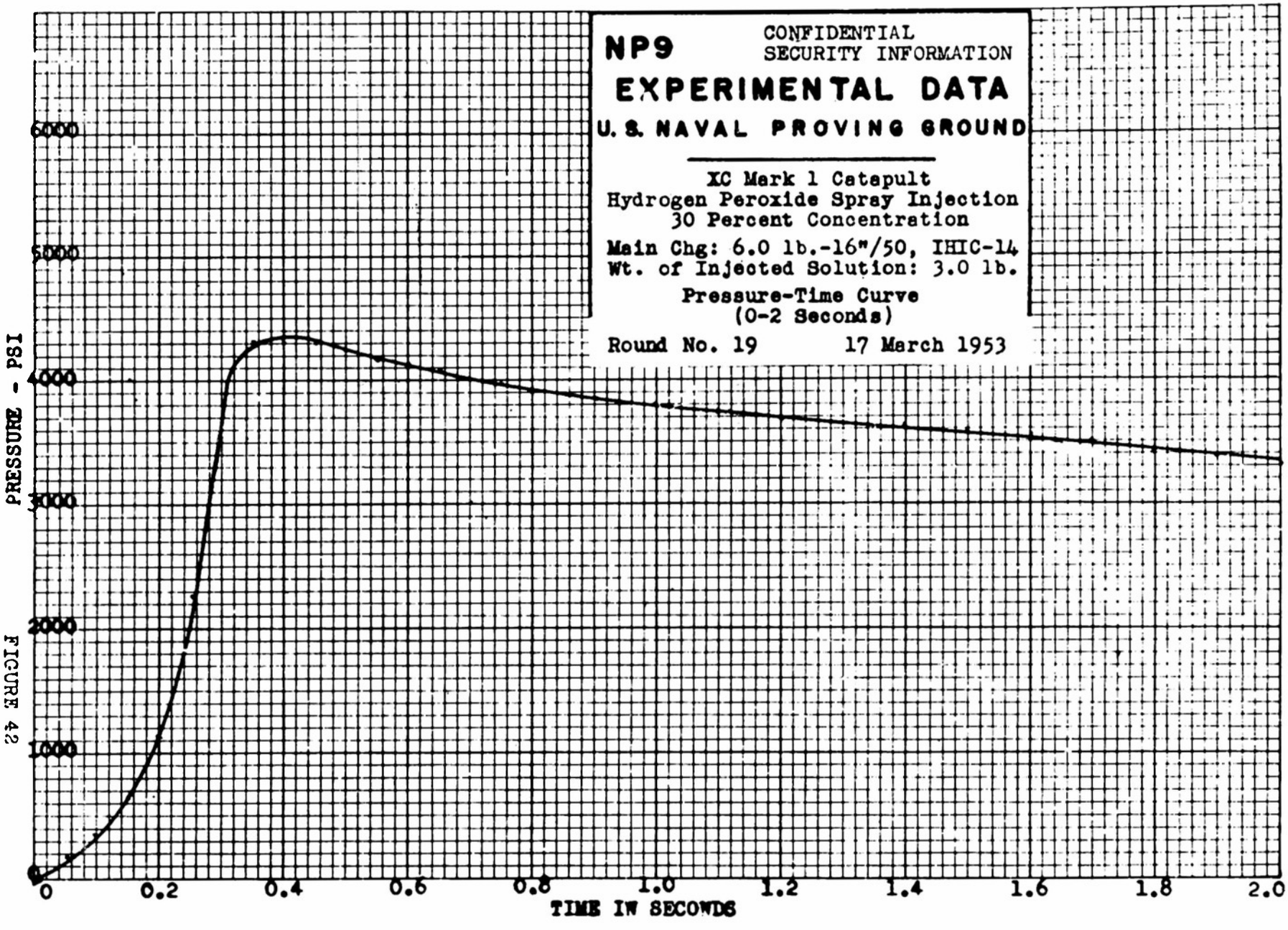

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 19
17 March 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 42

CONFIDENTIAL
SECURITY INFORMATION

NP9-

EXPERIMENTAL DATA

U. S. NAVAL PROVING GROUND

XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration

Main Chg: 6.0 lb.-16"/50, IMIC-14
Wt. of Injected Solution: 3.0 lb.

Pressure-Time Curve
(0-2 Seconds)

Round No. 26 10 April 1953

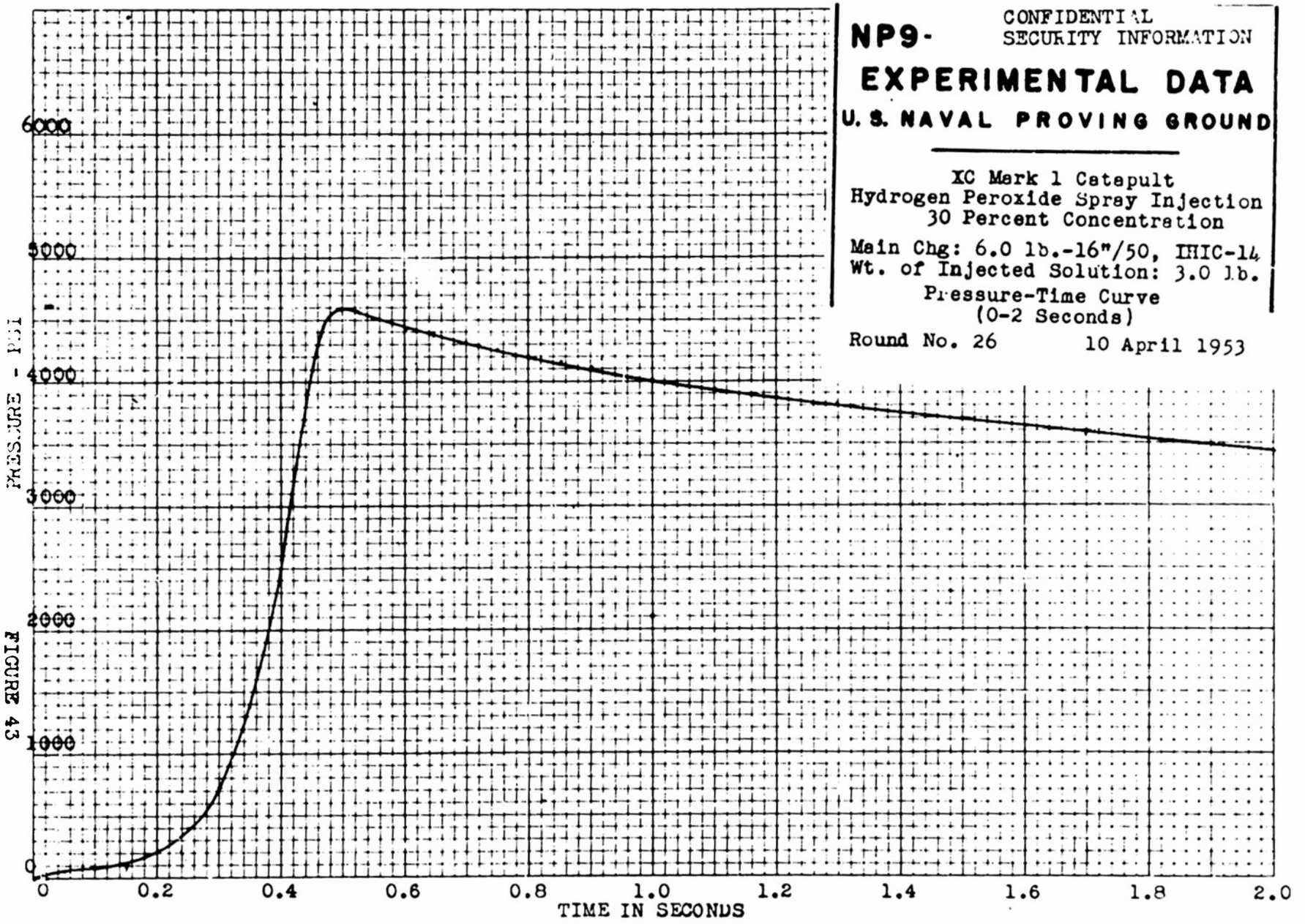


FIGURE 43

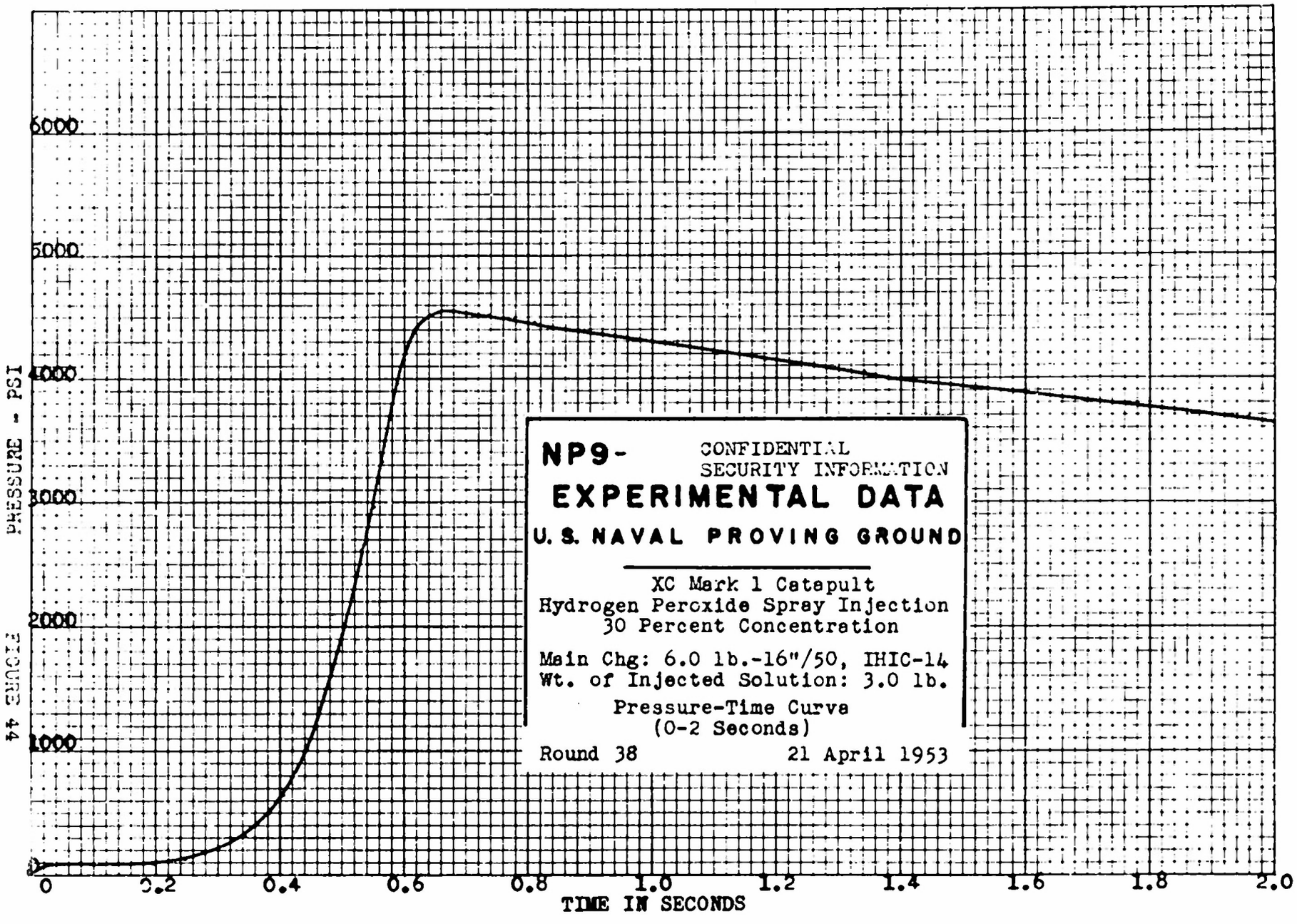

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 38
21 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 44

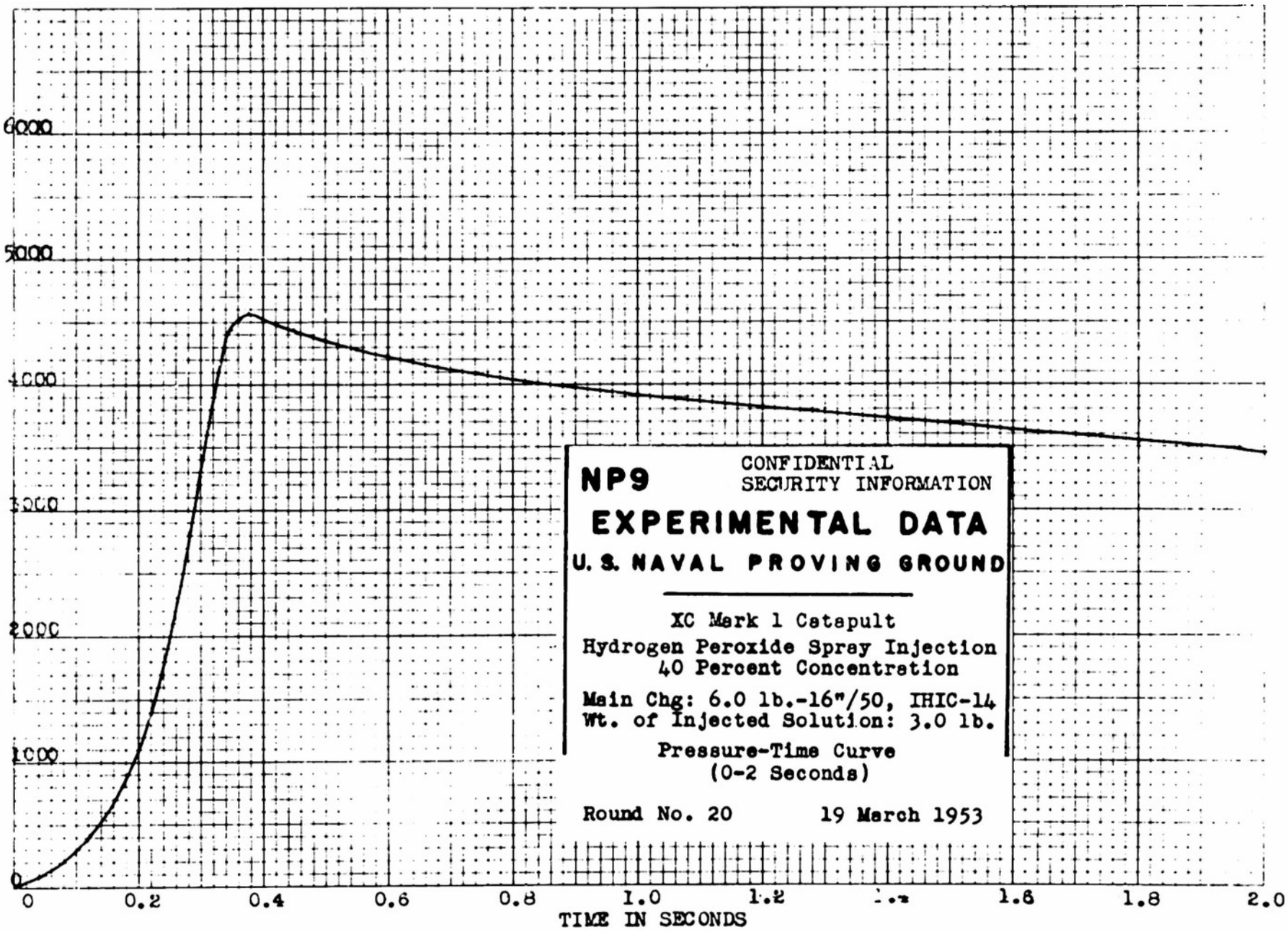

6000
5000
4000
3000
2000
1000
0
PRESSURE - PSI
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS
NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 20
19 March 1953

FIGURE 45

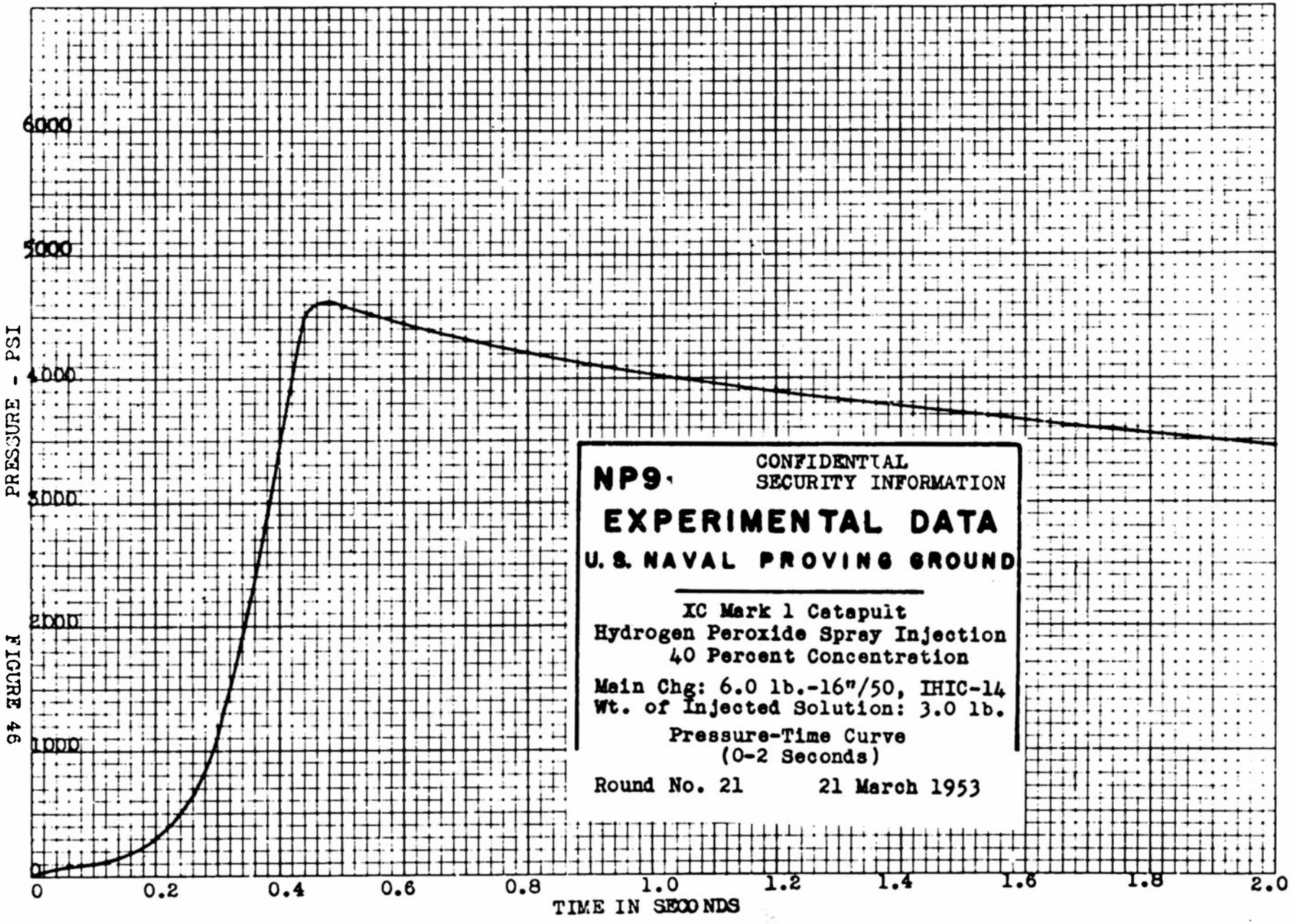

6000
5000
4000
3000
2000
1000
0
PRESSURE - PSI
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS
NP9.
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 21 21 March 1953

FIGURE 46

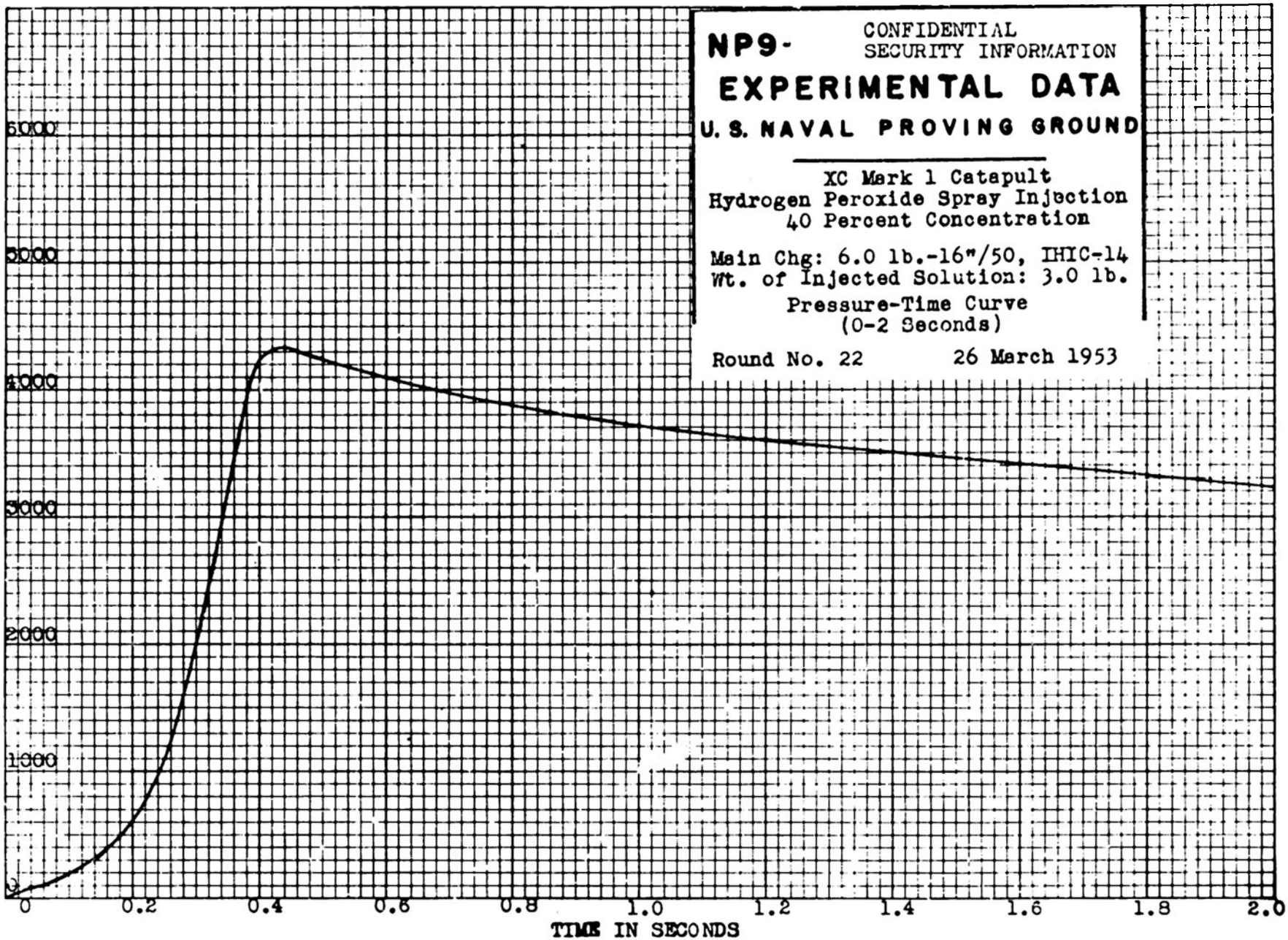

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 22
26 March 1953
PRESSURE - PSI
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 47

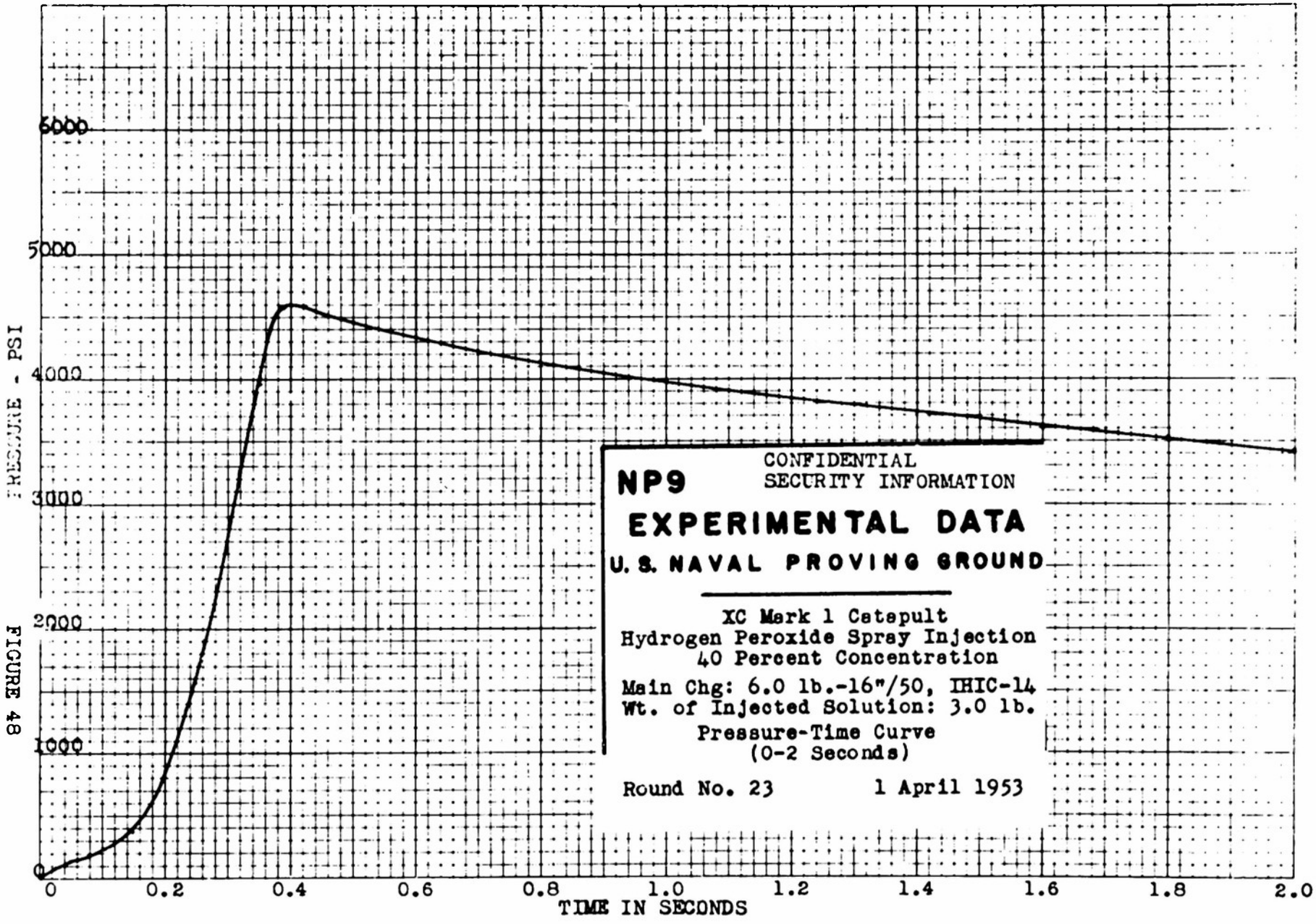

6000
5000
4000
3000
2000
1000
0
PRESSURE - PSI
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS
NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 23
1 April 1953

FIGURE 48

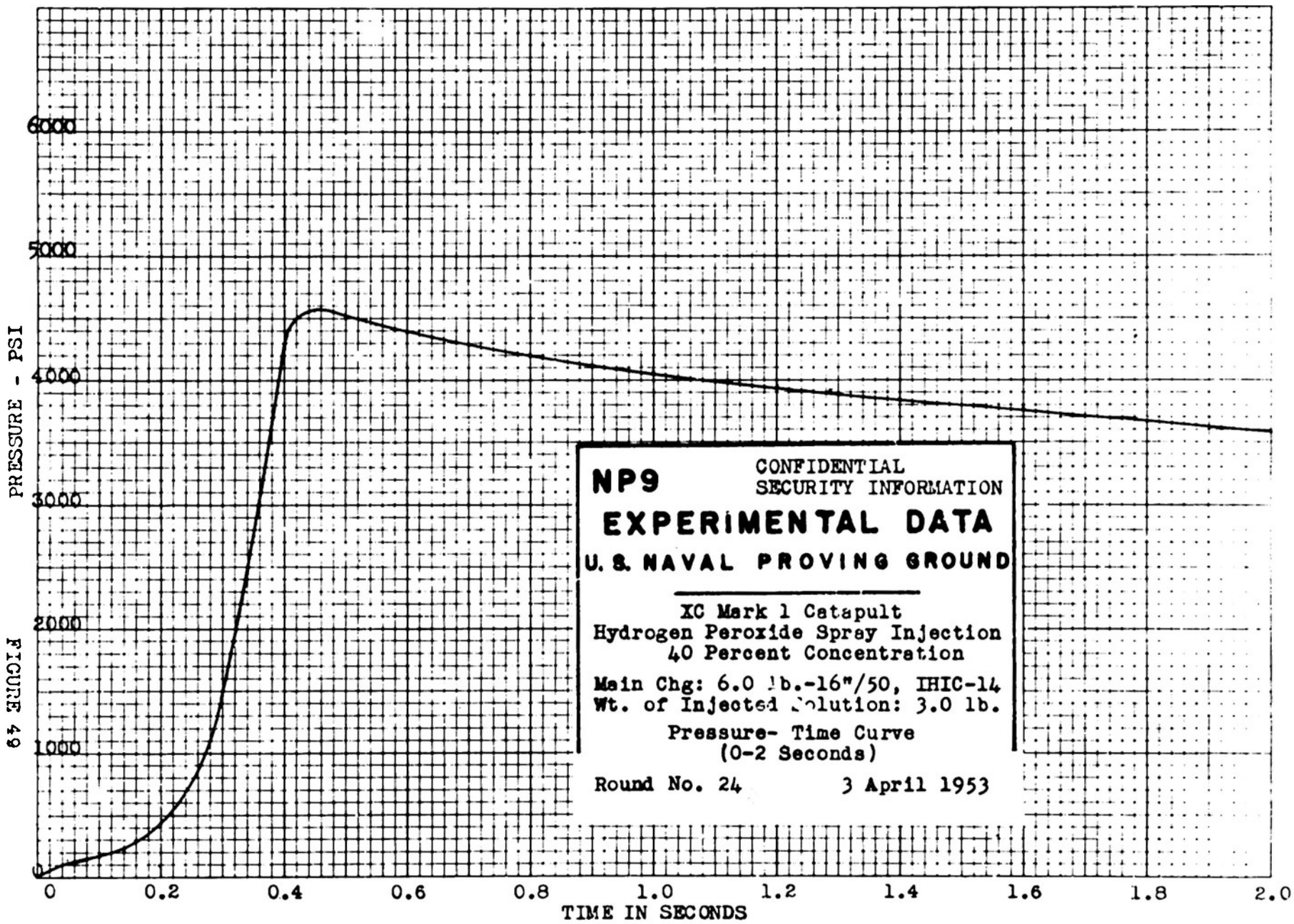

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure- Time Curve
(0-2 Seconds)
Round No. 24
3 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 49

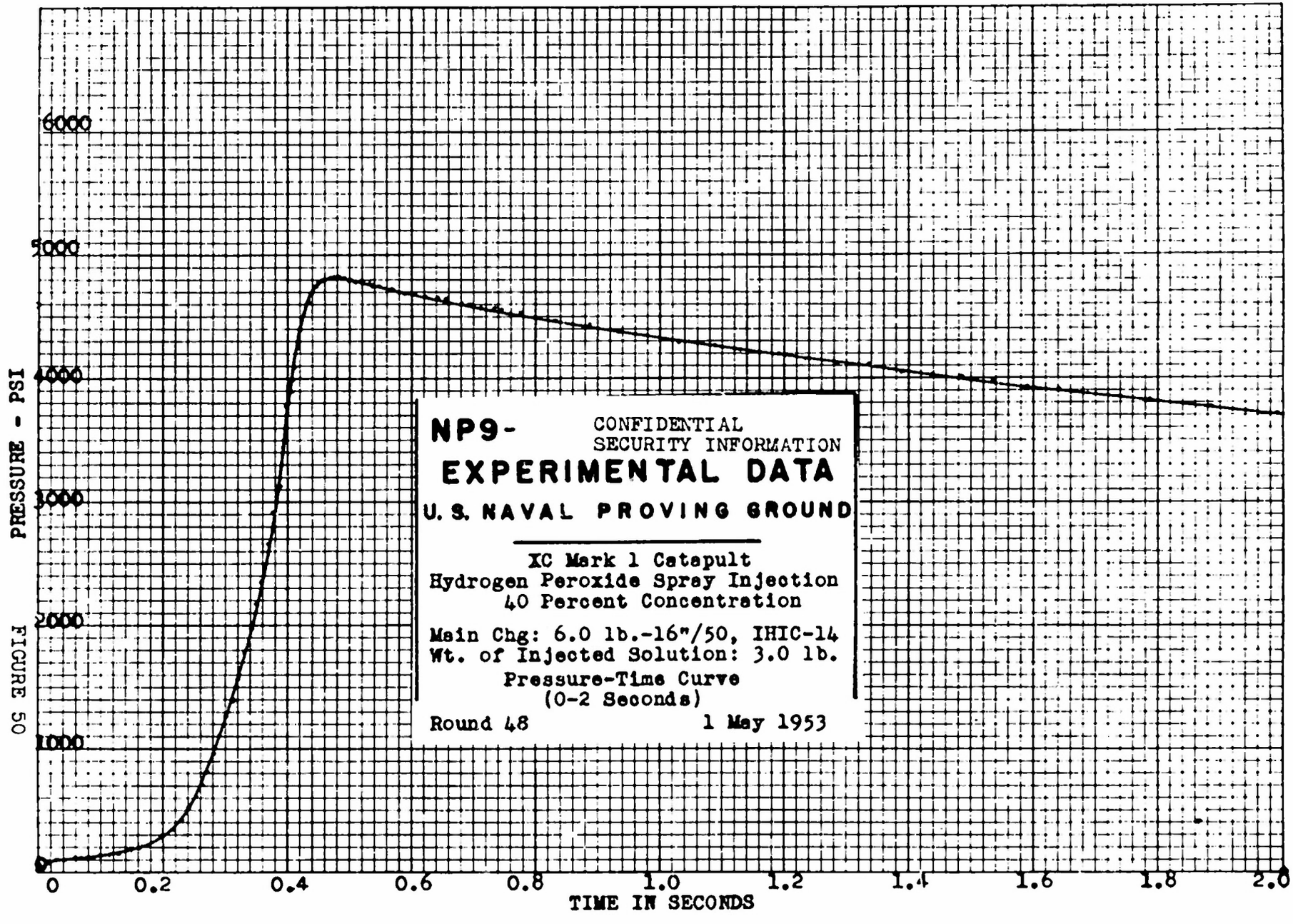

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 48
1 May 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 50

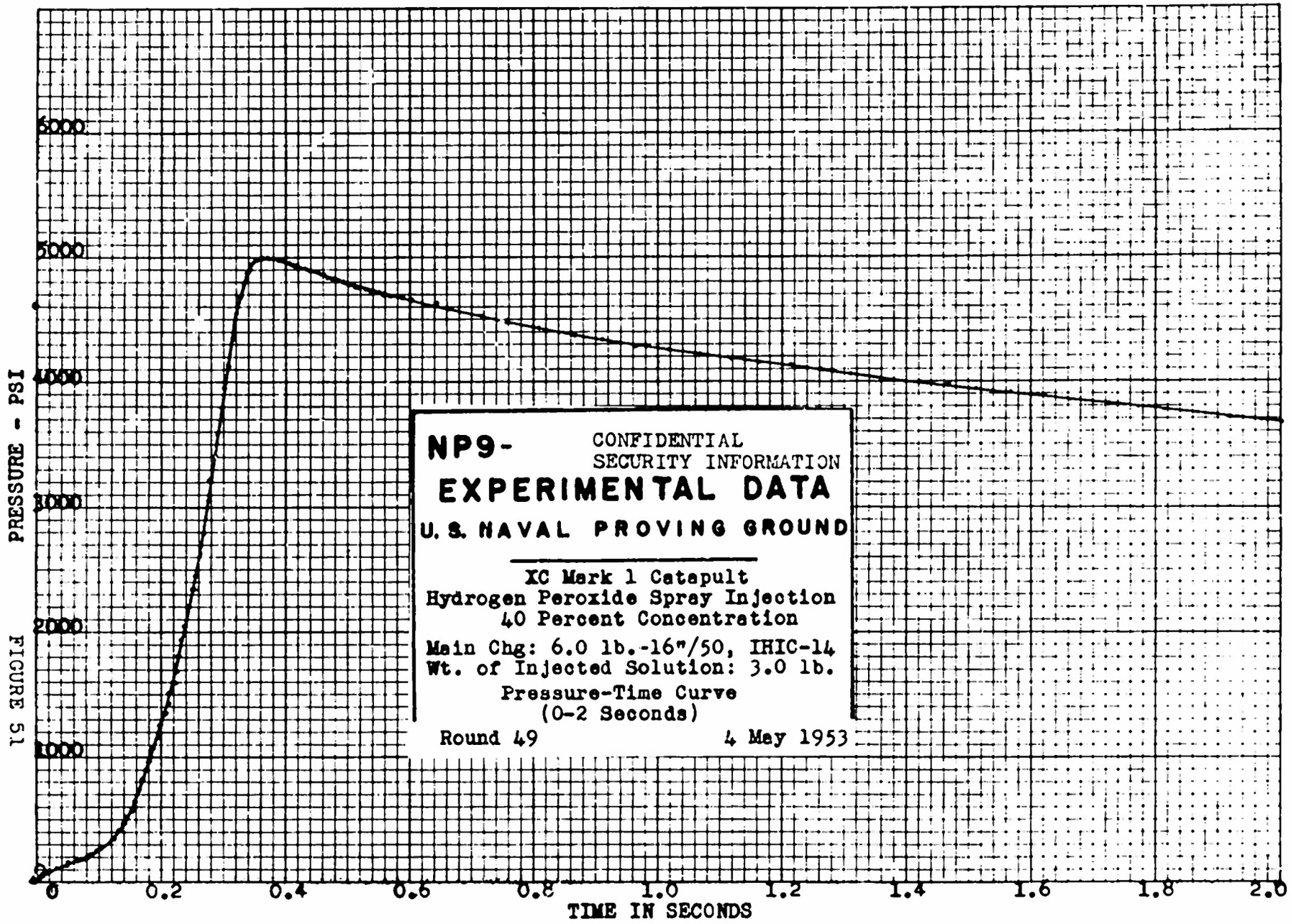

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 49
4 May 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 51

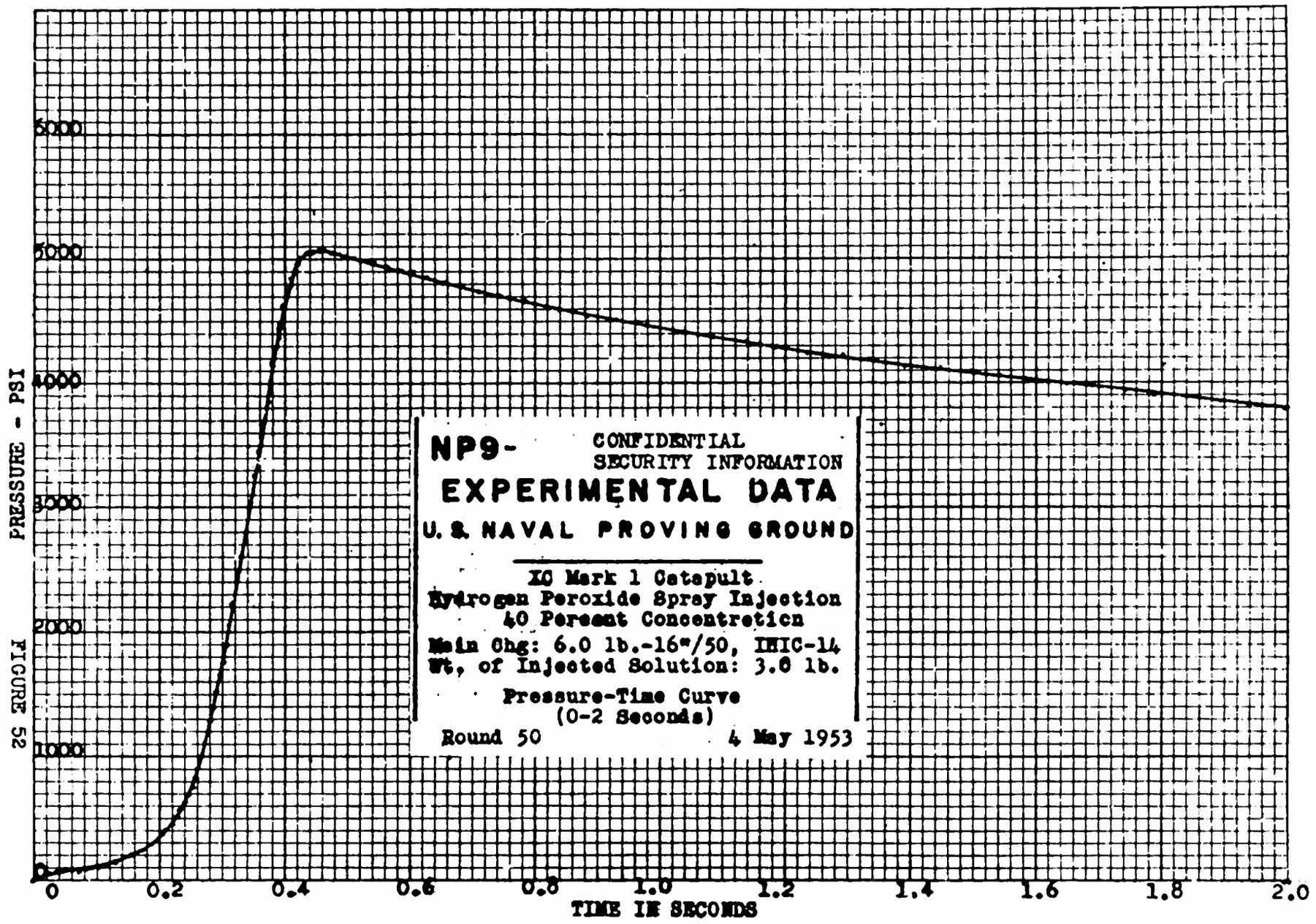

PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS
NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IMIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 50
4 May 1953

FIGURE 52

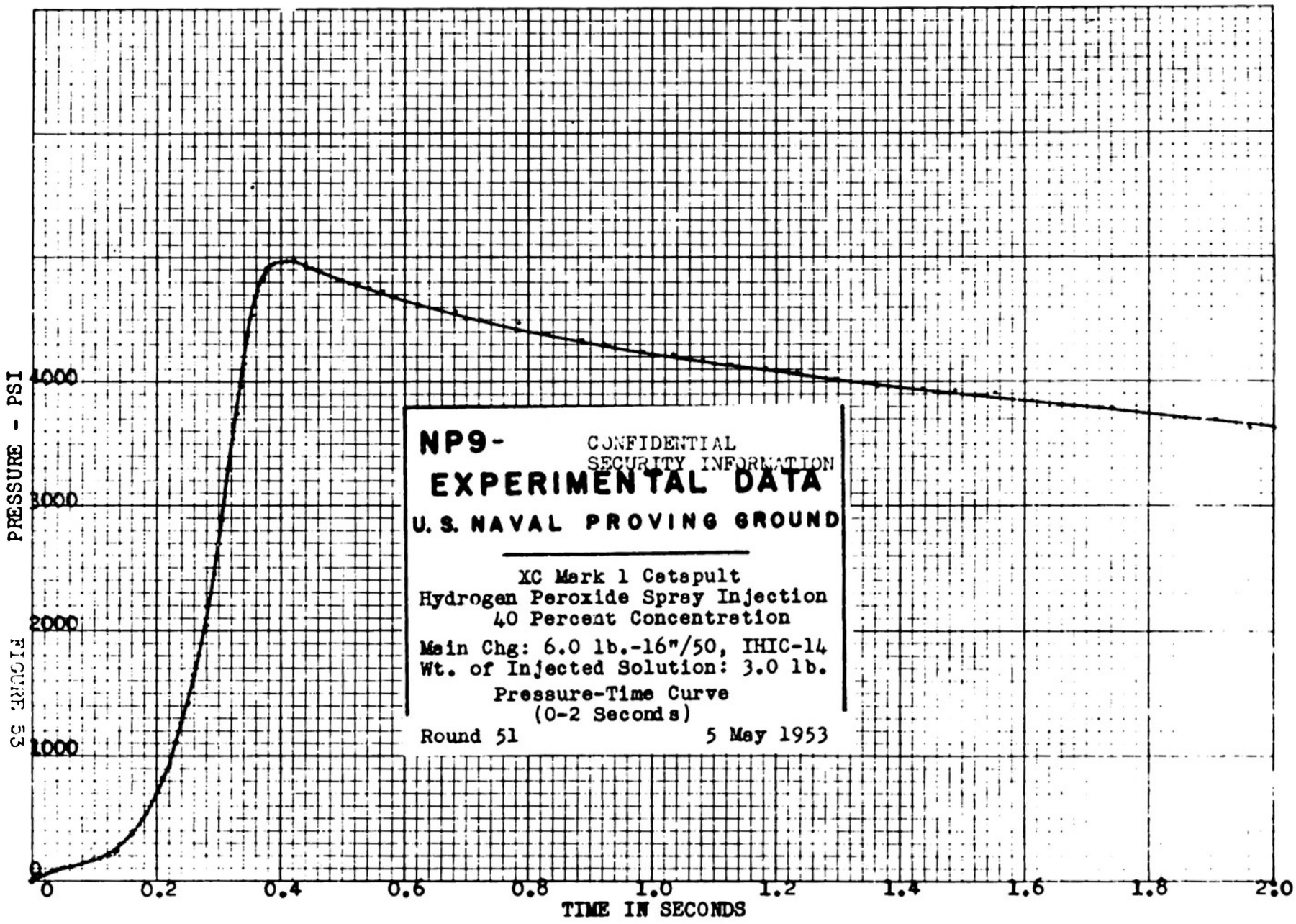

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 51
5 May 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 33

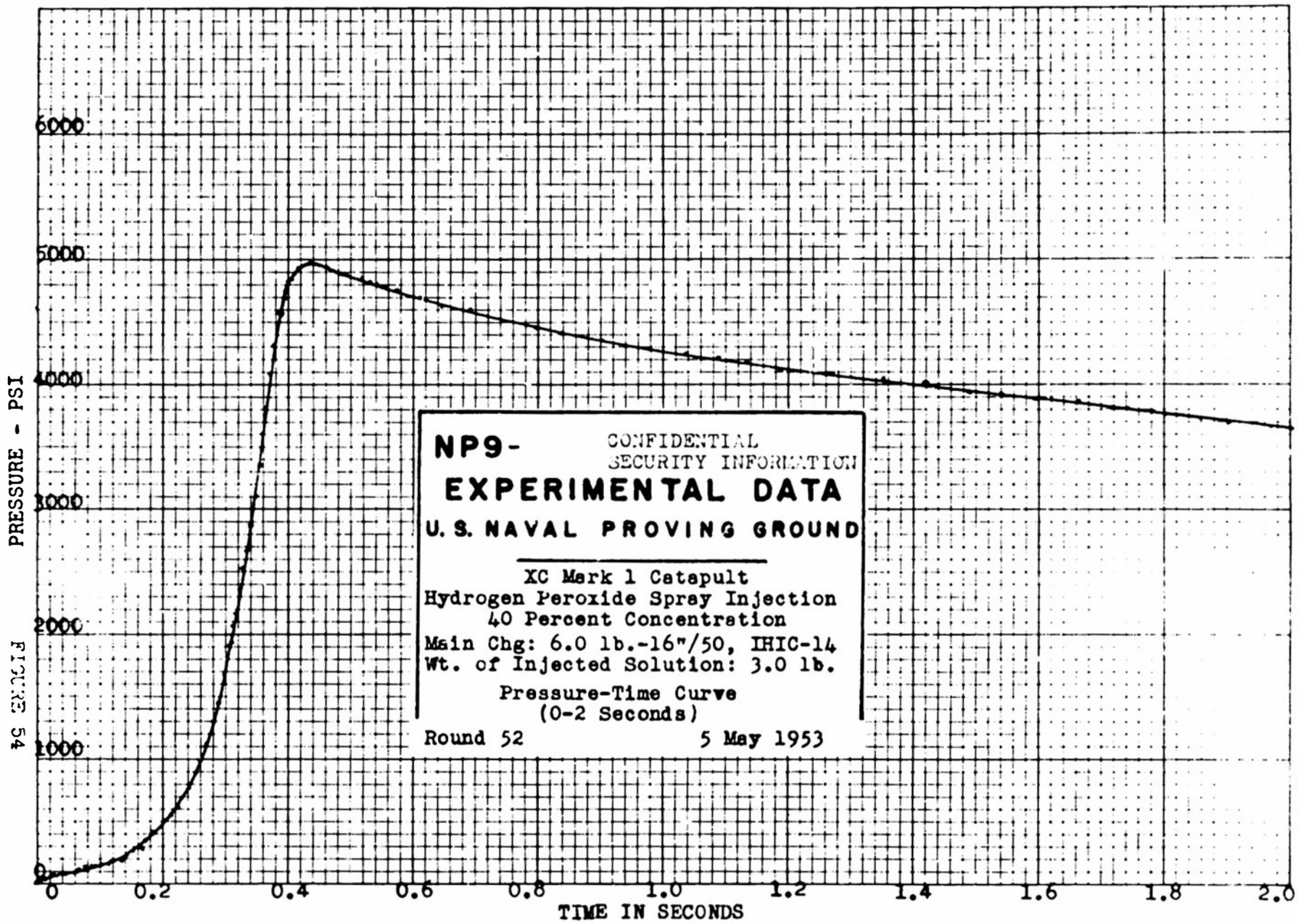

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 52
5 May 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 54

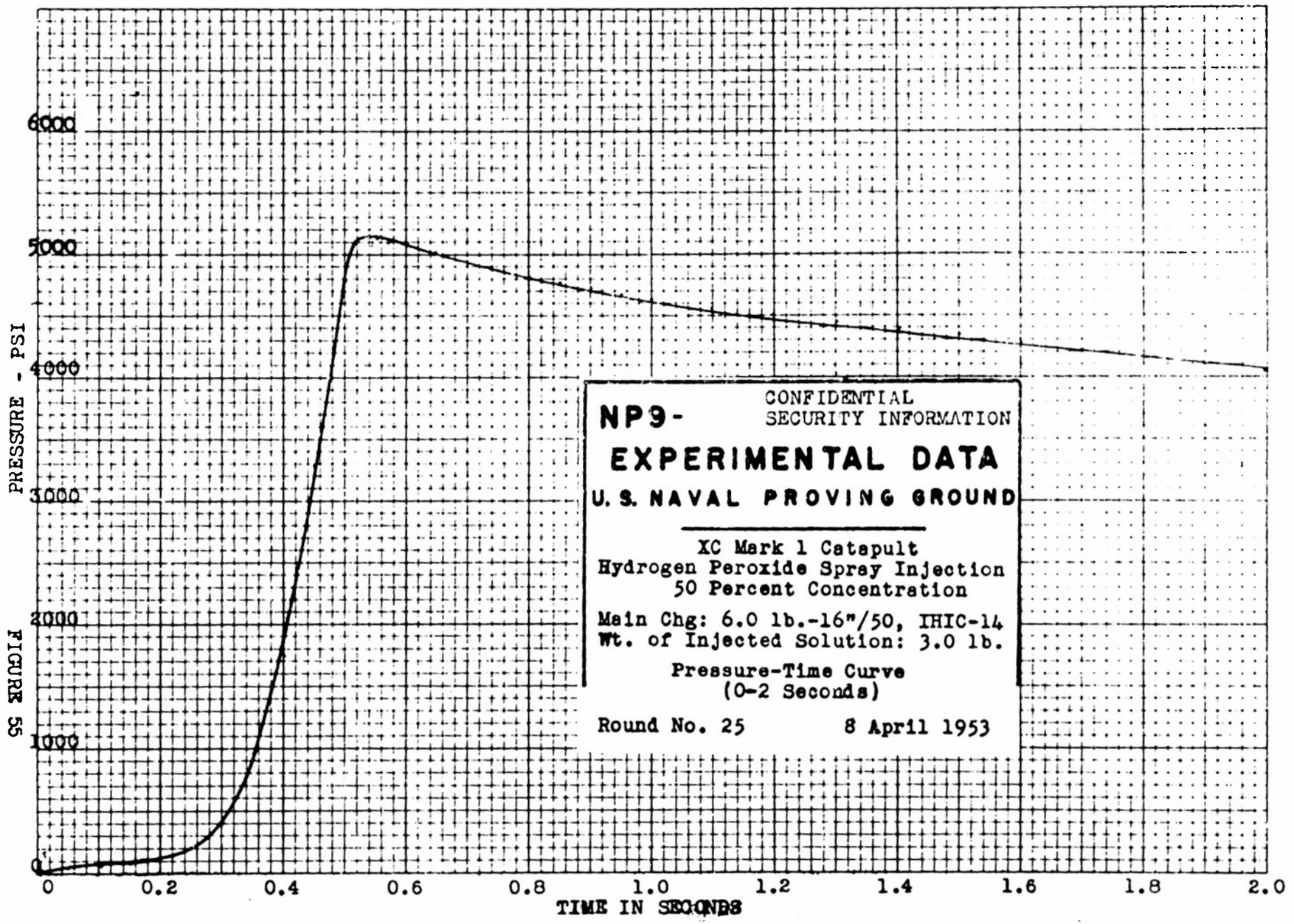

6000
5000
4000
3000
2000
1000
0
PRESSURE - PSI
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS
NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 25
8 April 1953

FIGURE 56

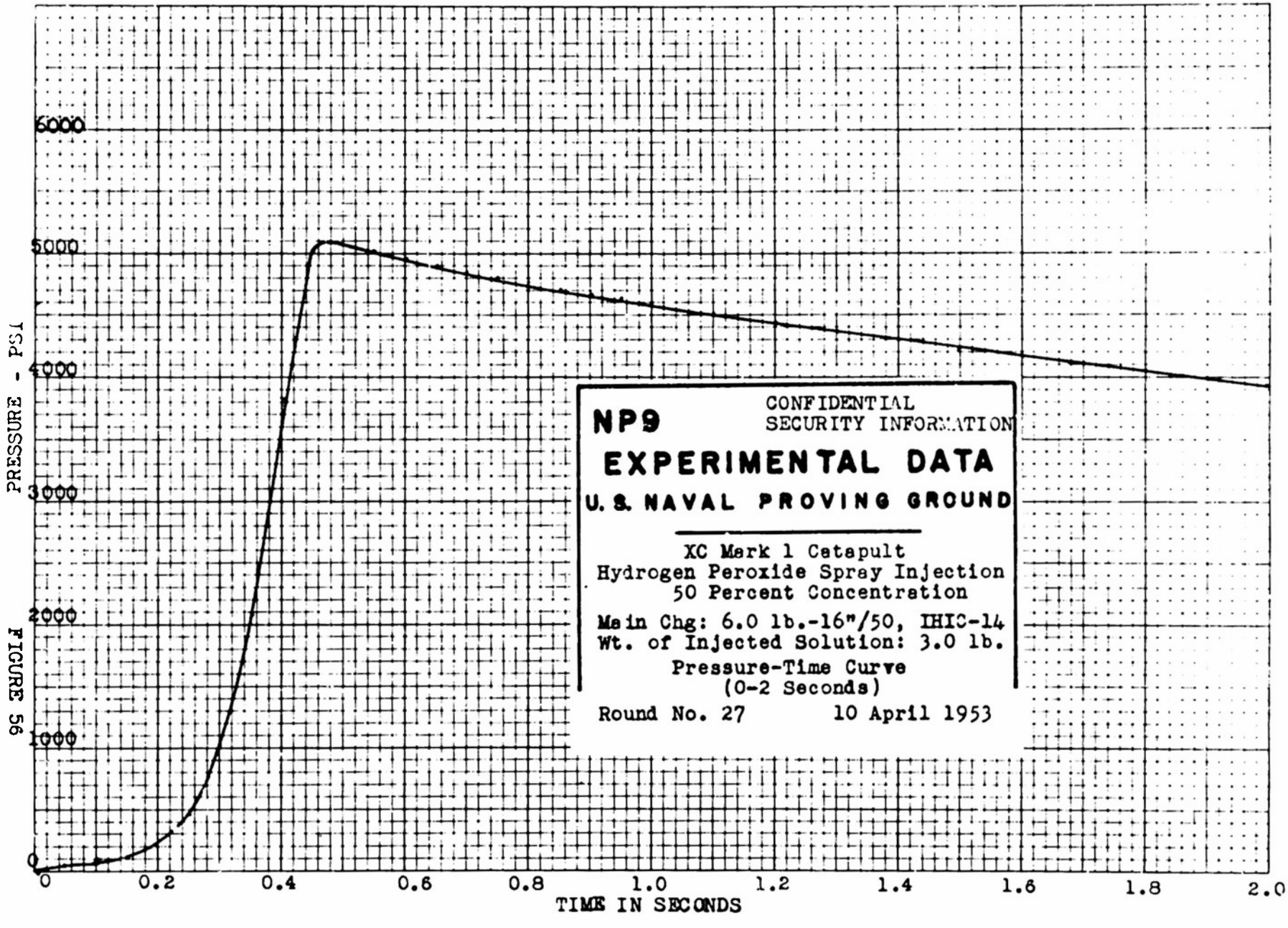

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 27 10 April 1953
PRESSURE - PSI
TIME IN SECONDS
0
1000
2000
3000
4000
5000
6000
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

FIGURE 56

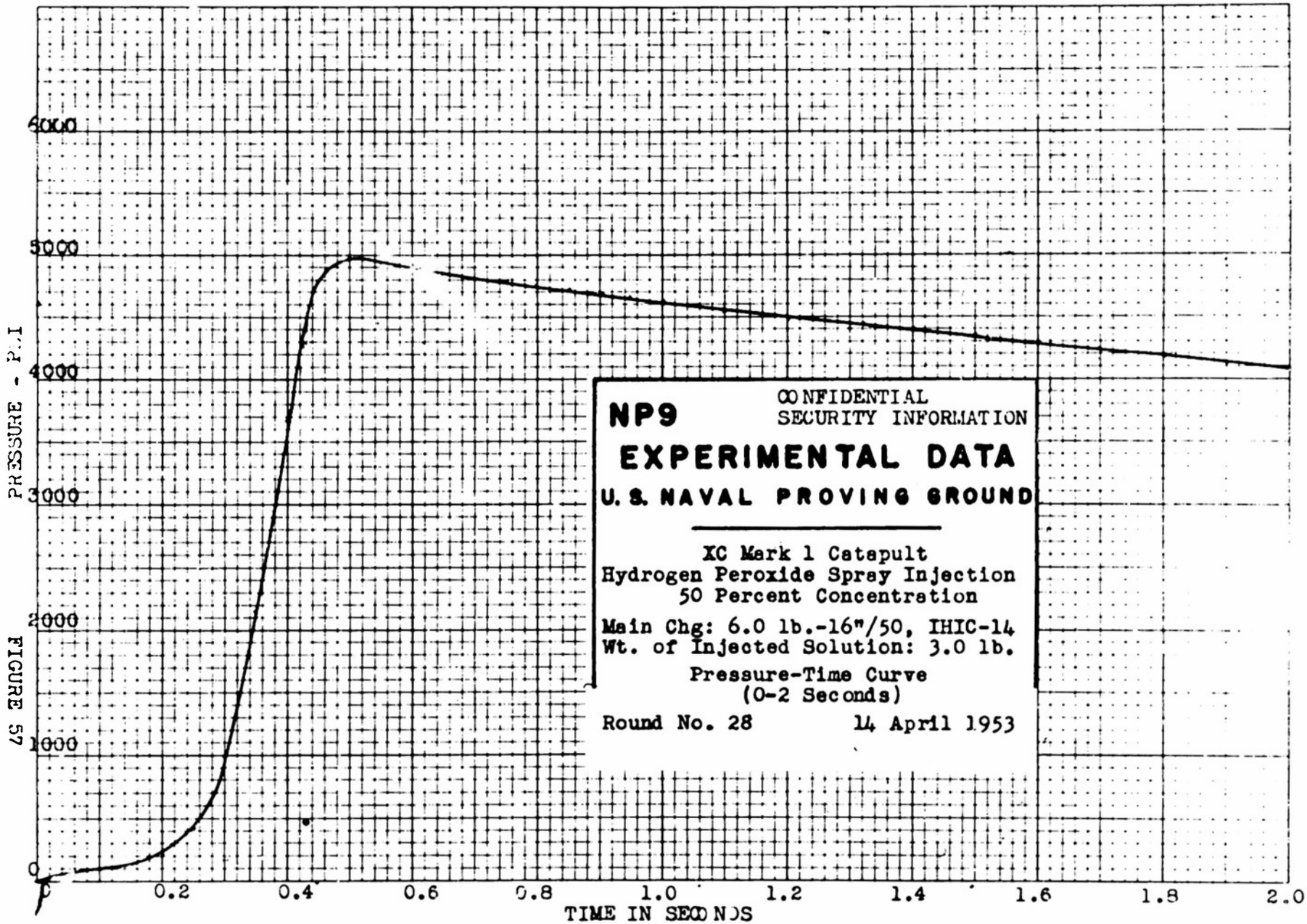

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 28
14 April 1953
PRESSURE - P.S.I
TIME IN SECONDS
0
1000
2000
3000
4000
5000
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

FIGURE 57

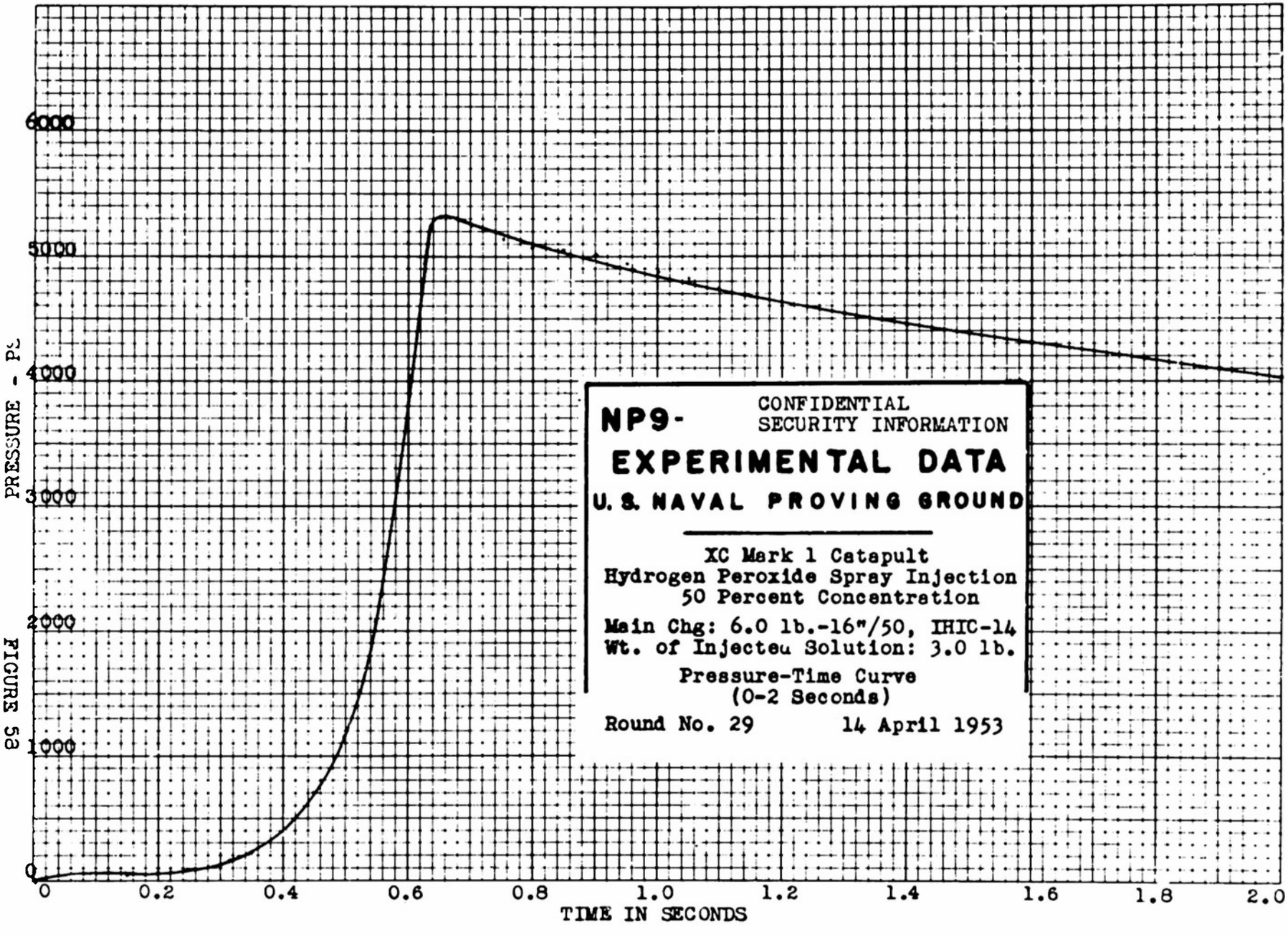

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round No. 29 14 April 1953
PRESSURE - PS
6000
5000
4000
3000
2000
1000
0
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
TIME IN SECONDS

FIGURE 52

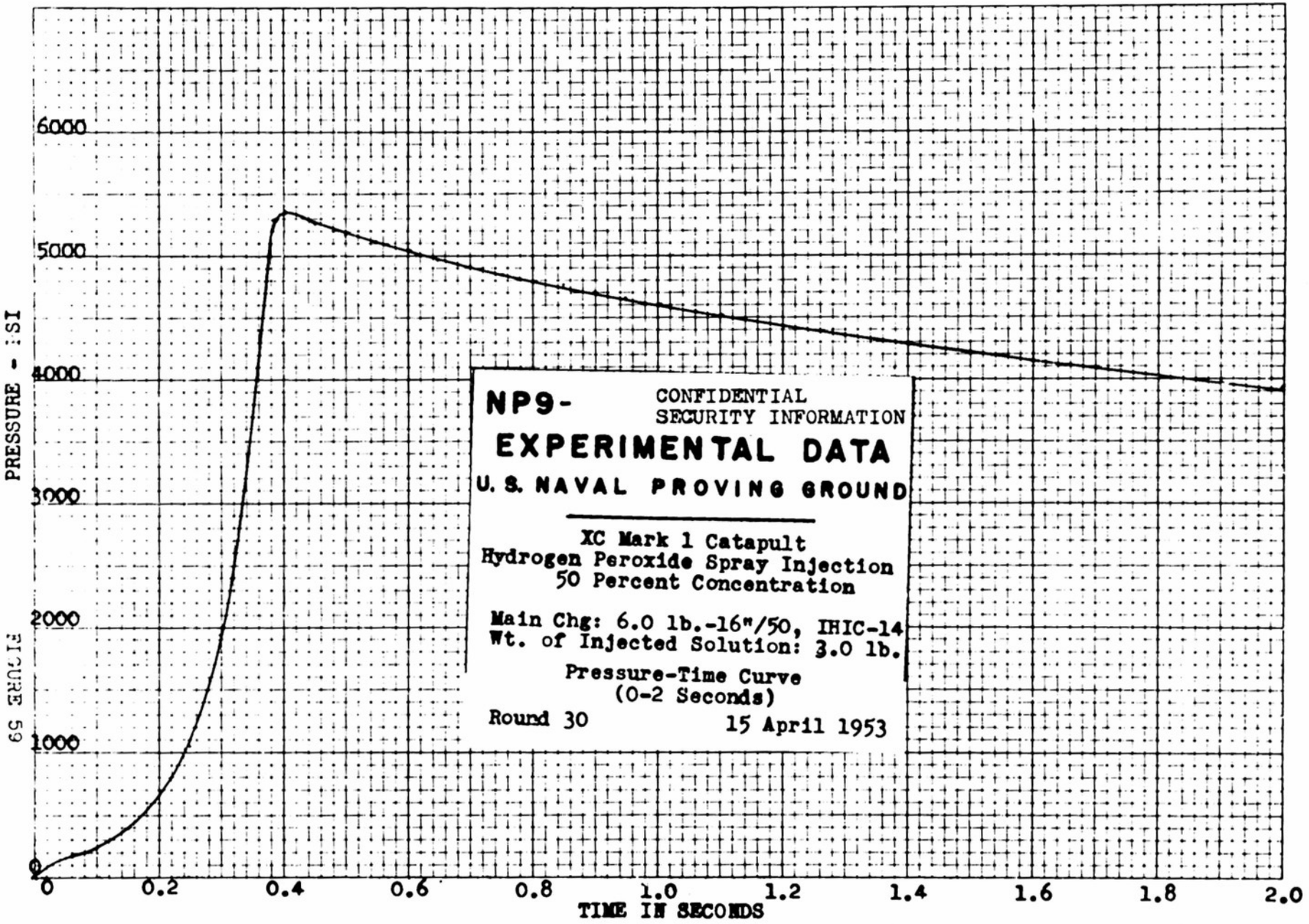
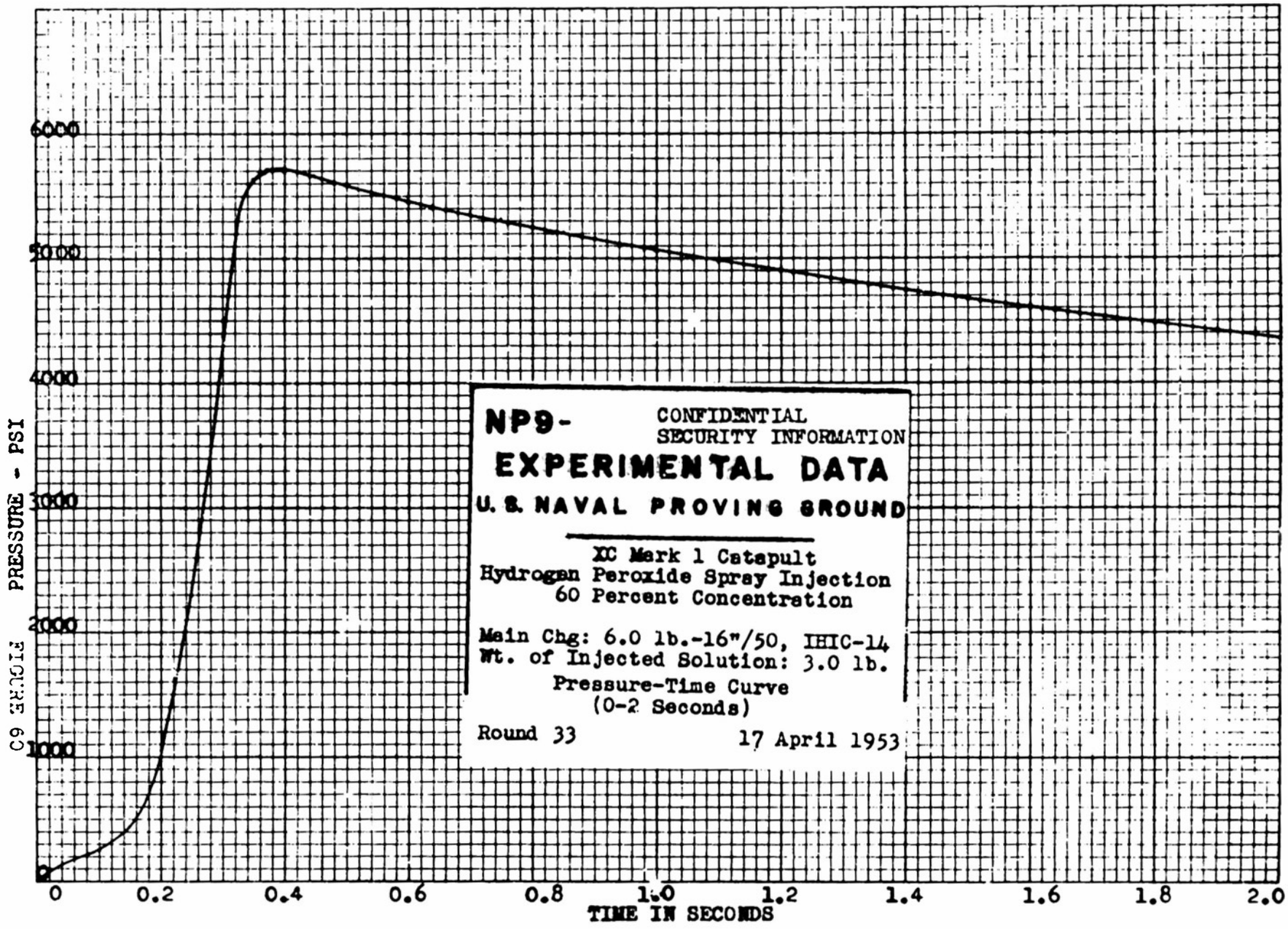

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 30
15 April 1953
PRESSURE - PSI
TIME IN SECONDS
0
1000
2000
3000
4000
5000
6000
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

FIGURE 59


NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 33
17 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

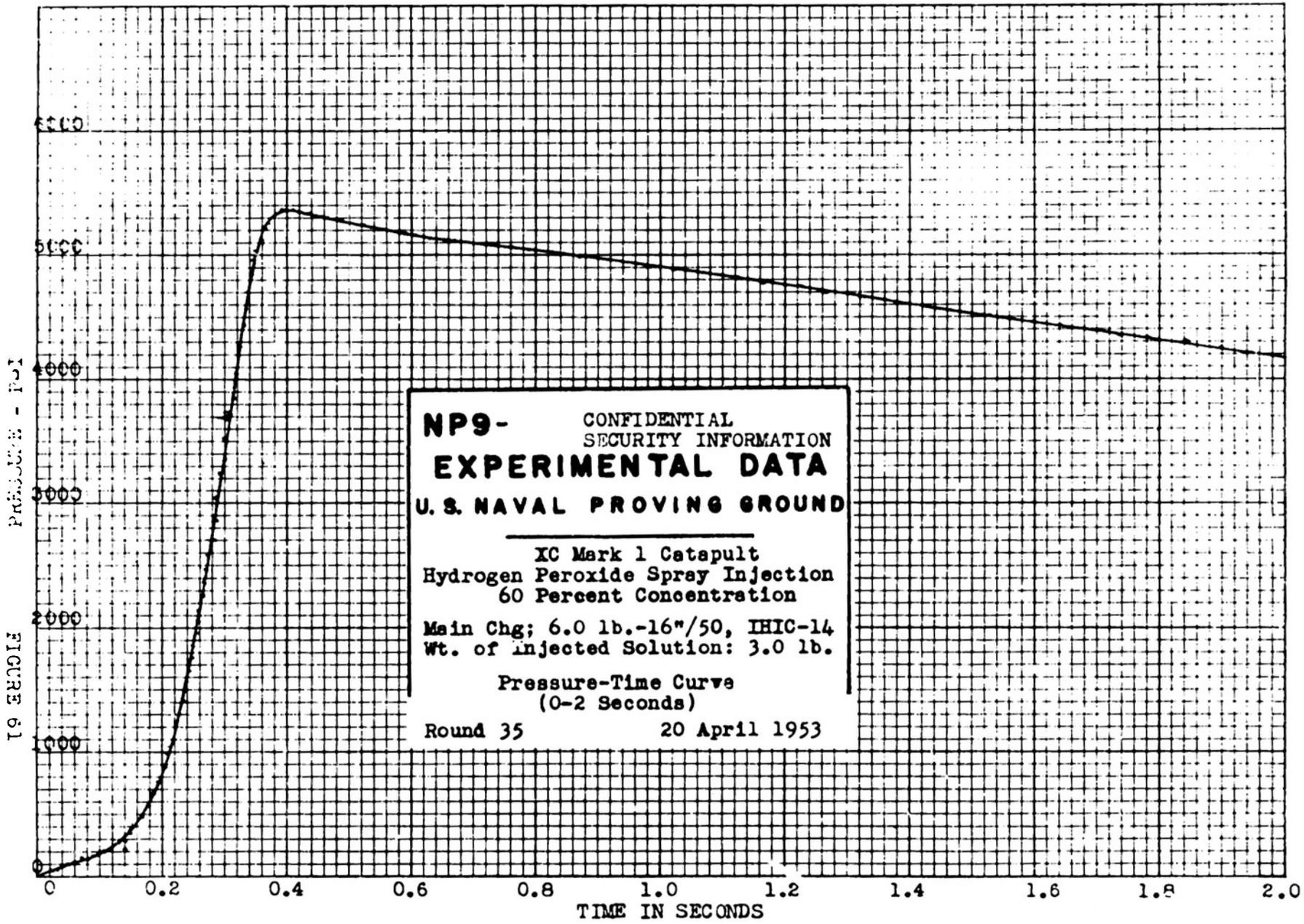

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg; 6.0 lb.-16"/50, IHIC-14
Wt. of injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 35
20 April 1953
PRESSURE - PSI
0
1000
2000
3000
4000
5000
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 61

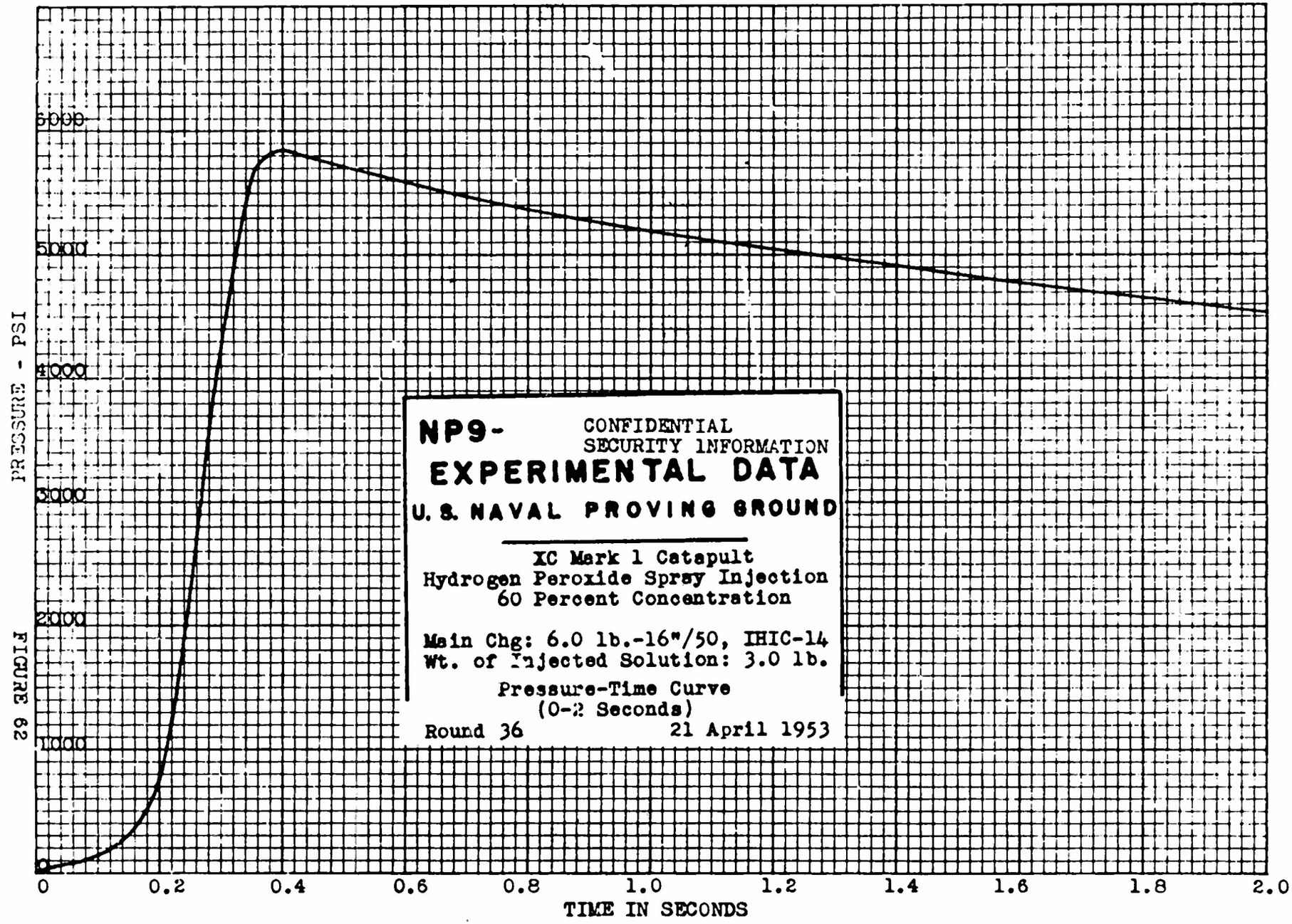

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 36
21 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 62

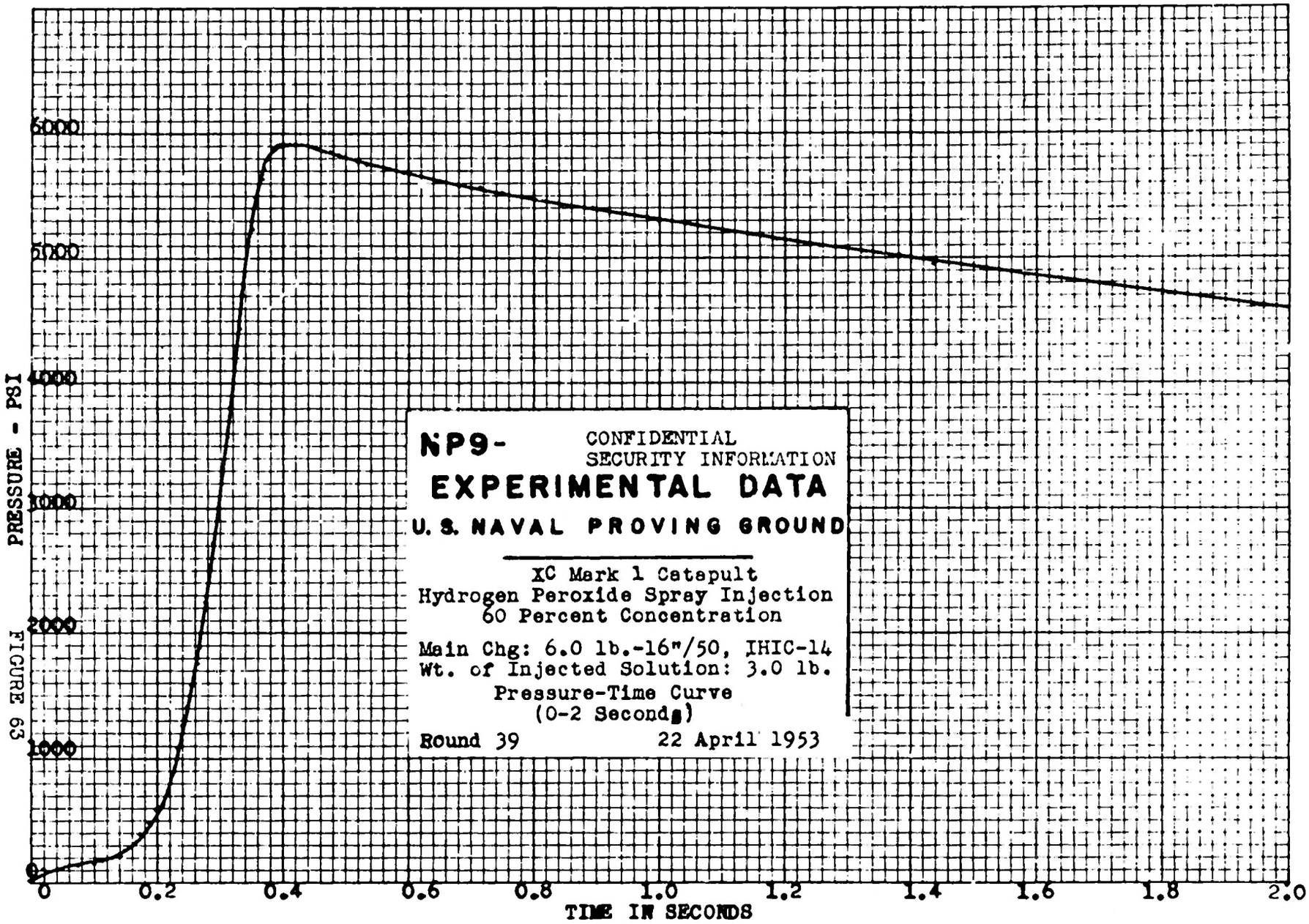

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 39
22 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 63

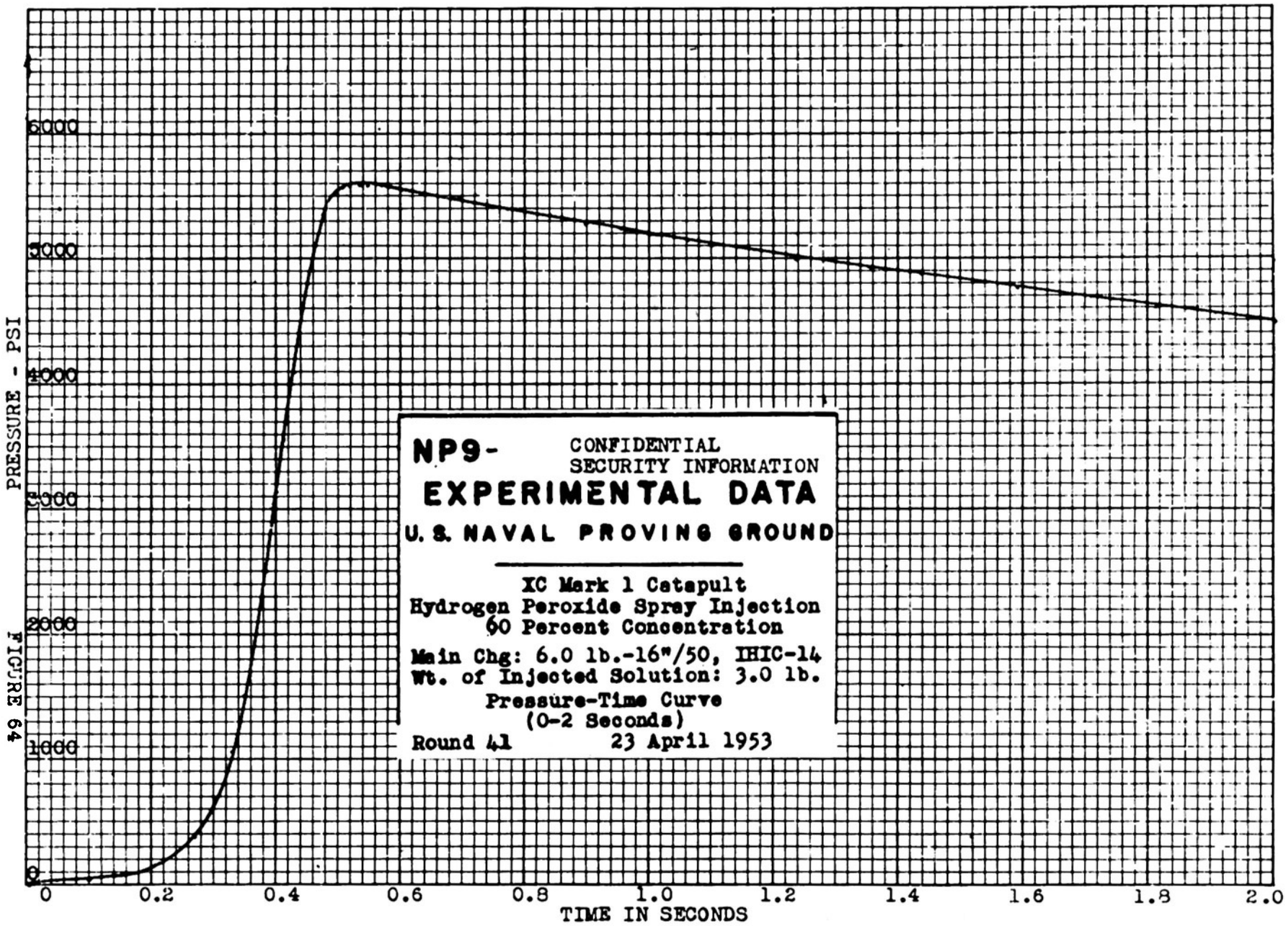

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
90 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-2 Seconds)
Round 41 23 April 1953
PRESSURE - PSI
6000
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME IN SECONDS

FIGURE 64

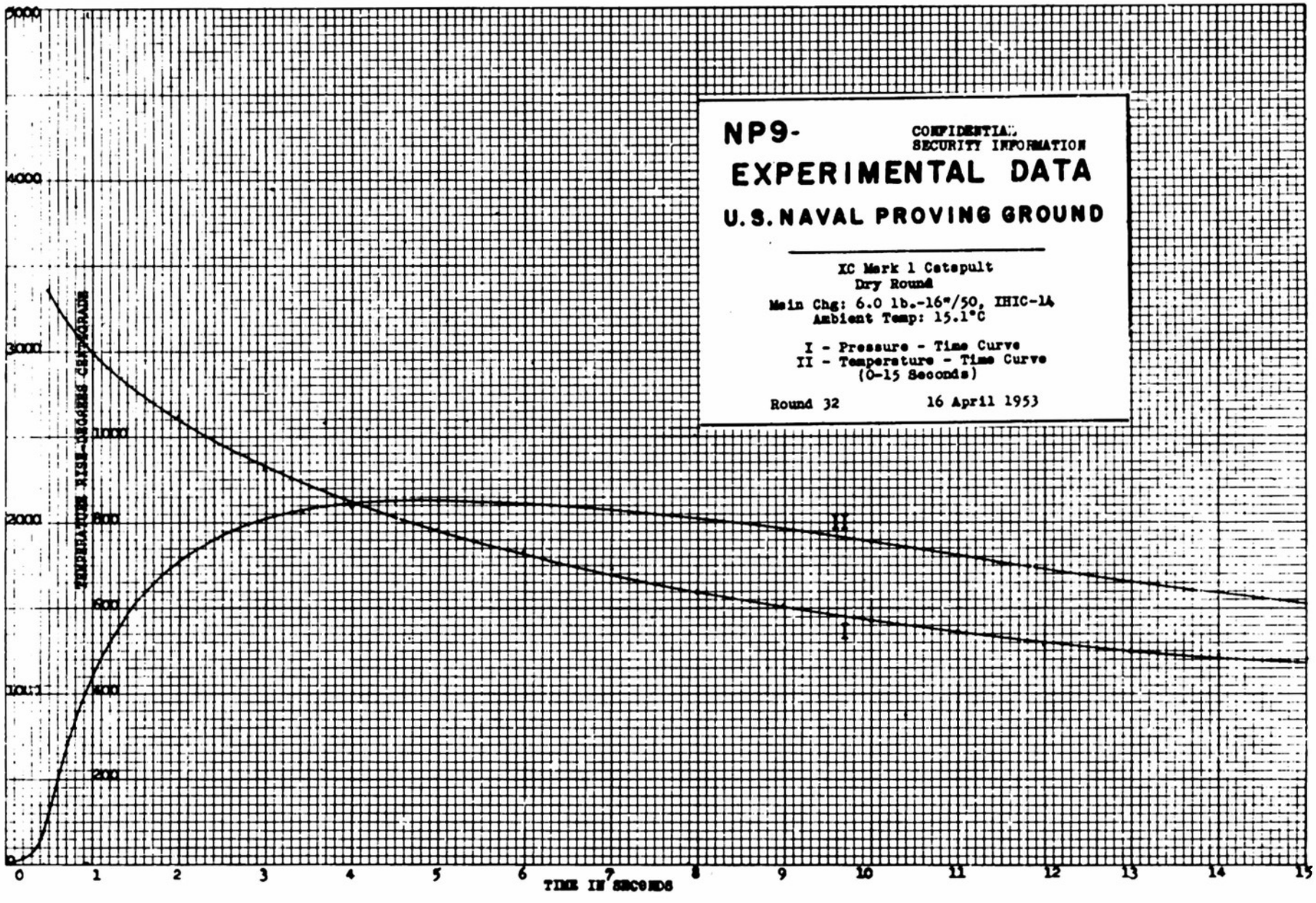

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Ambient Temp: 15.1°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 32
16 April 1953
PRESSURE - PSI
TEMPERATURE RISE - DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 55

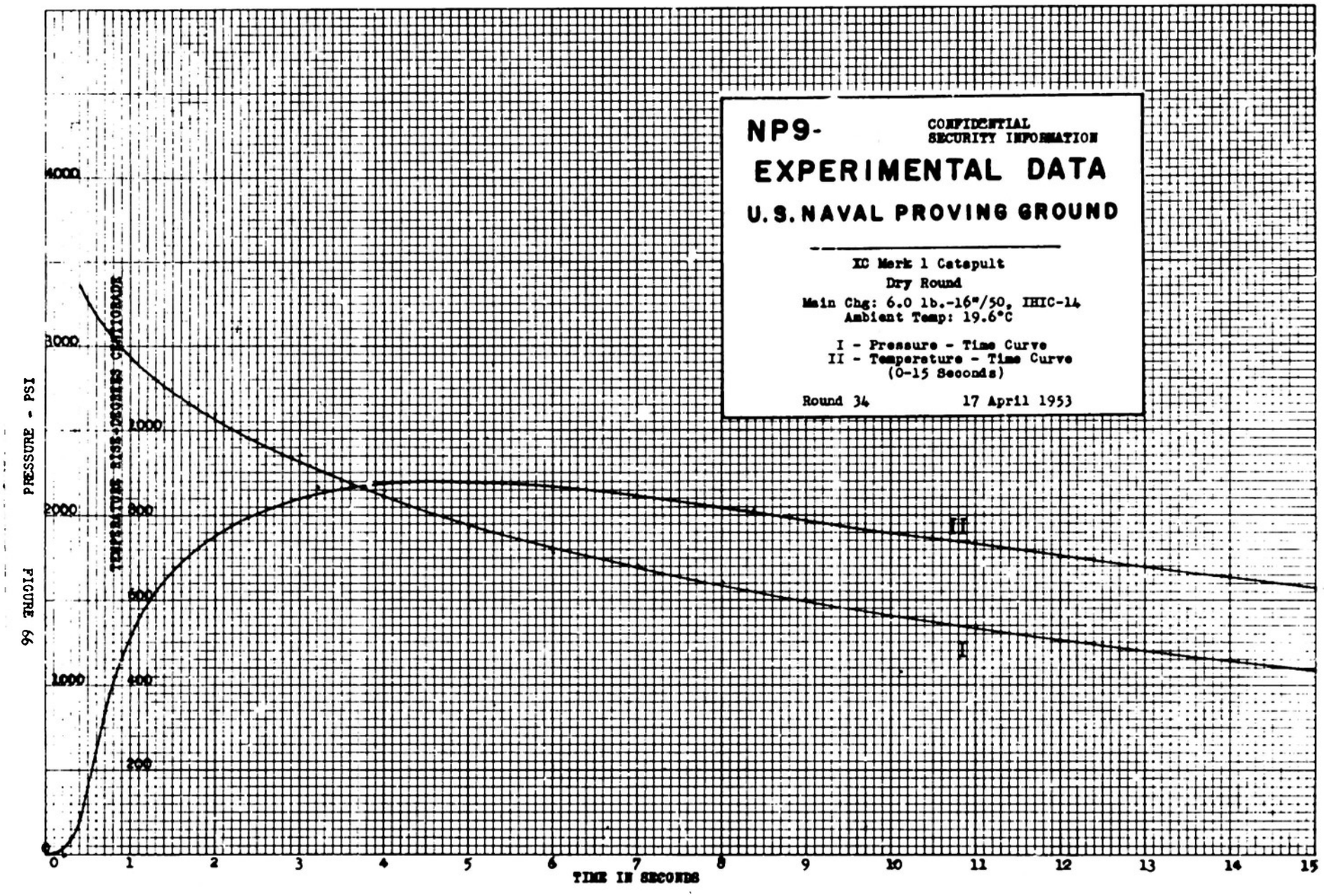

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Ambient Temp: 19.6°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 34
17 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
4000
3000
2000
1000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 66

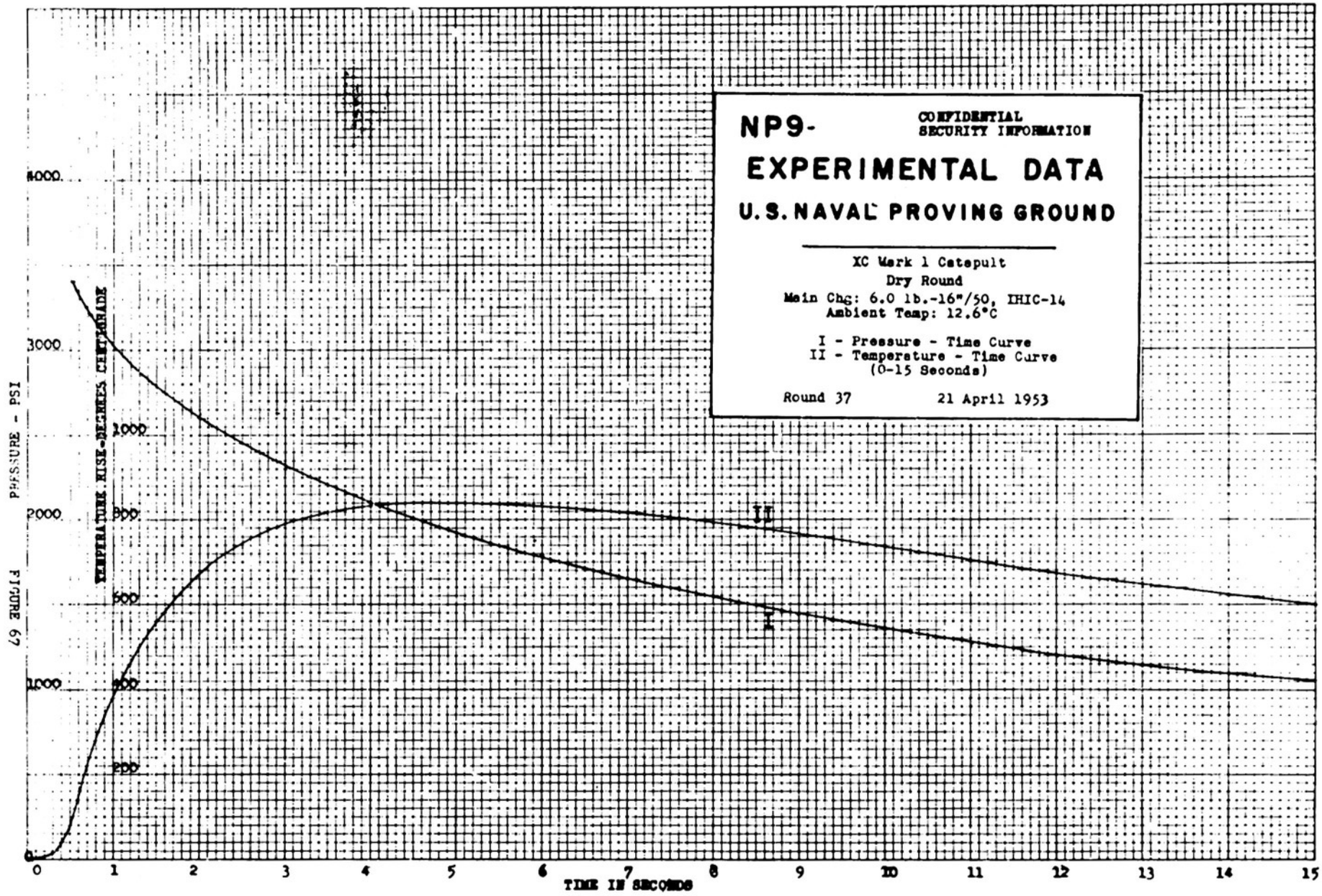

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Ambient Temp: 12.6°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 37
21 April 1953
PRESSURE - PSI
TEMPERATURE RISE - DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 67

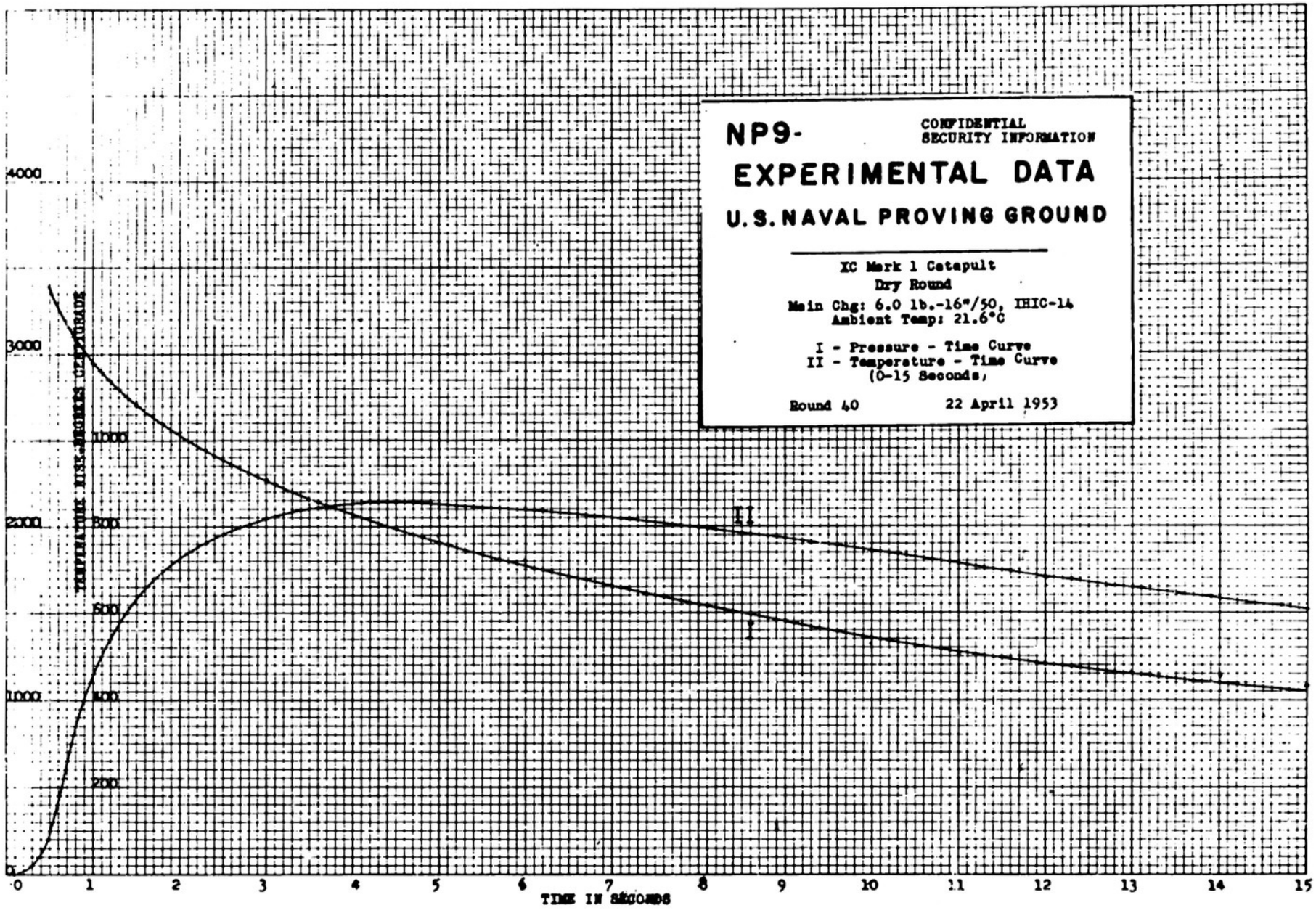

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Ambient Temp: 21.6°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 40
22 April 1953
PRESSURE - PSI
TEMPERATURE RISE - DEGREES CENTIGRADE
TIME IN SECONDS
4000
3000
2000
1000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 69

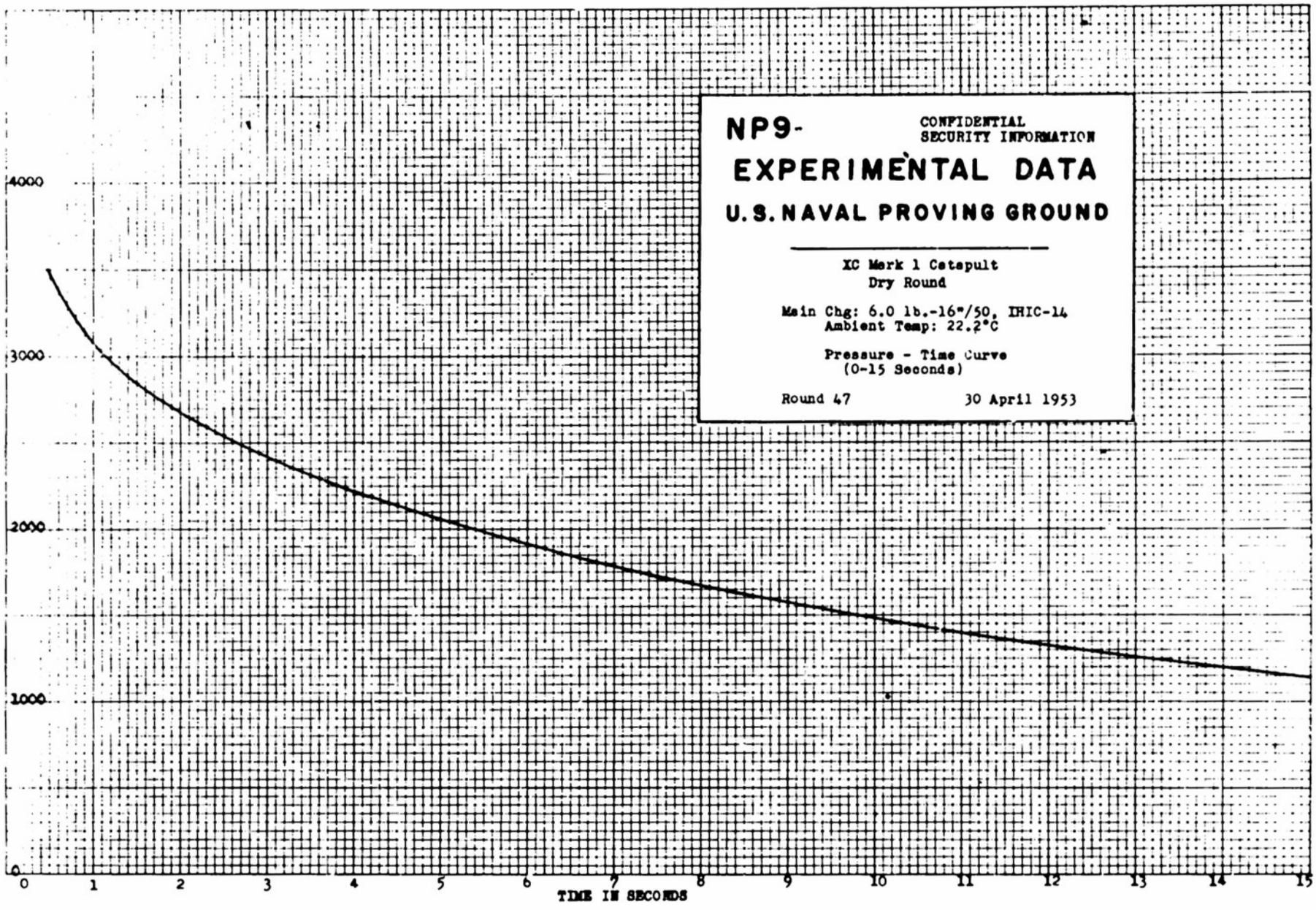

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Dry Round
Main Chg: 6.0 lb.-16"/50, IHIC-14
Ambient Temp: 22.2°C
Pressure - Time Curve
(0-15 Seconds)
Round 47
30 April 1953
4000
3000
2000
1000
0
psi - Pressure
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 69

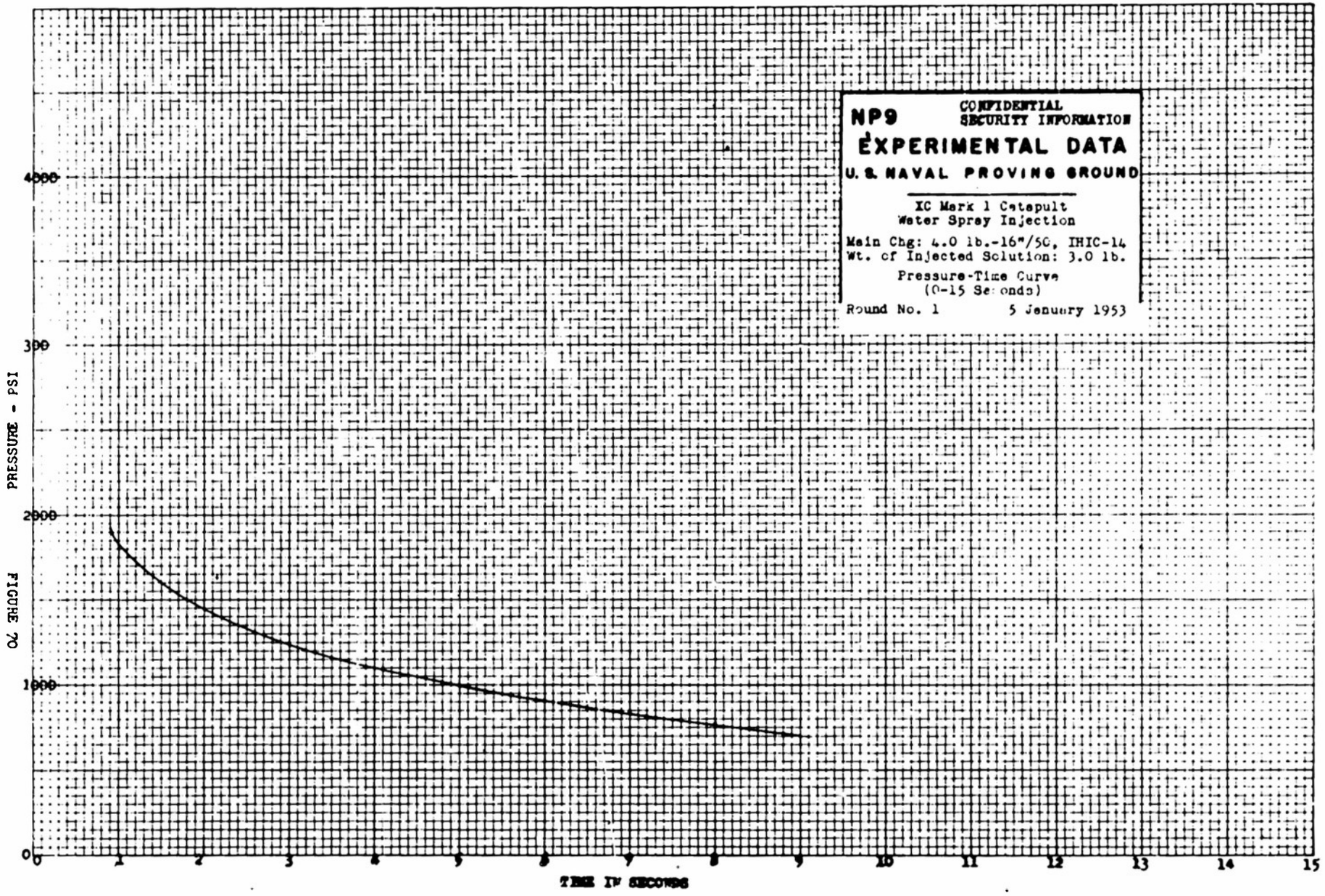

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 4.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 1
5 January 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 70

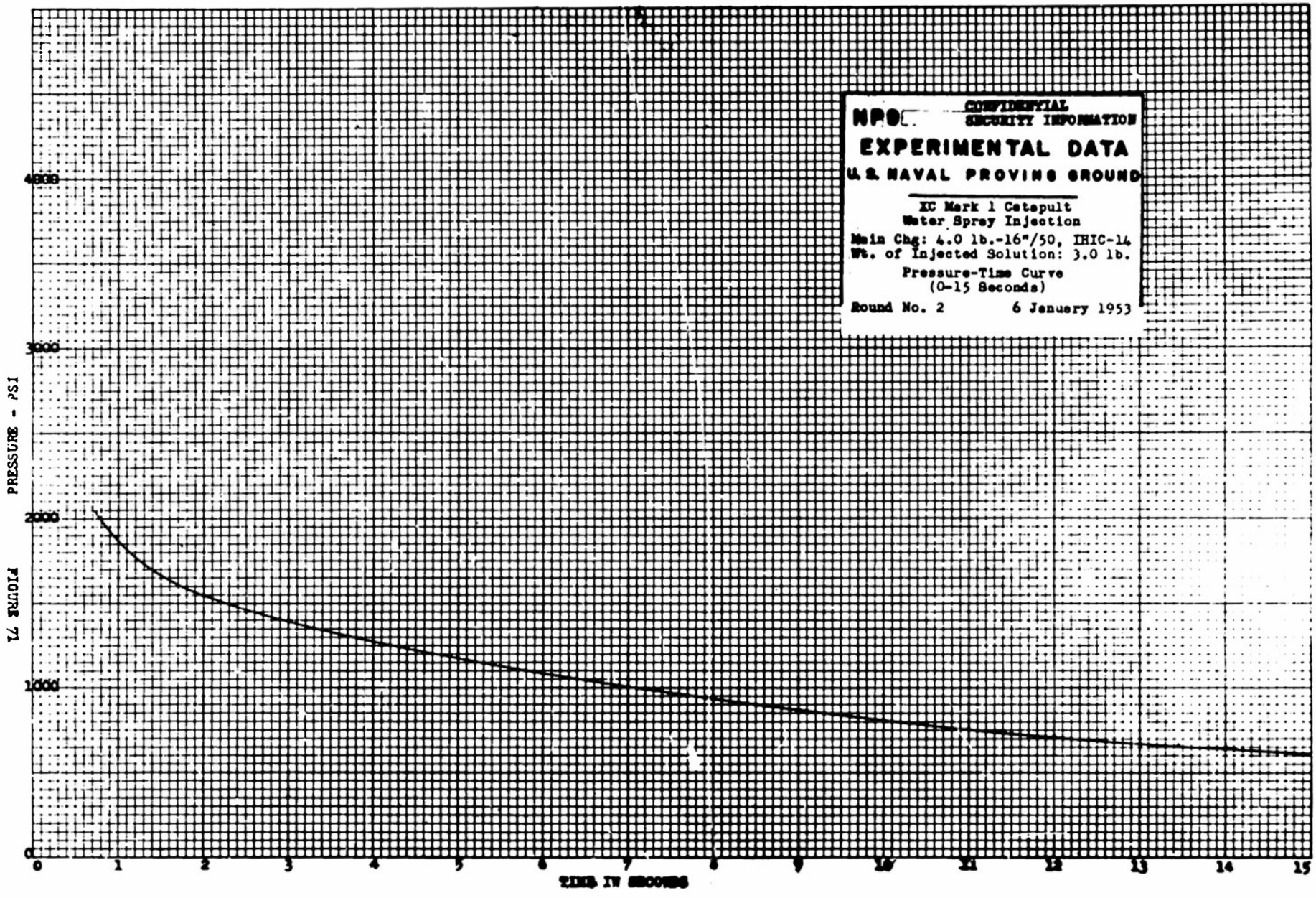

NPG
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 4.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 2
6 January 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 71

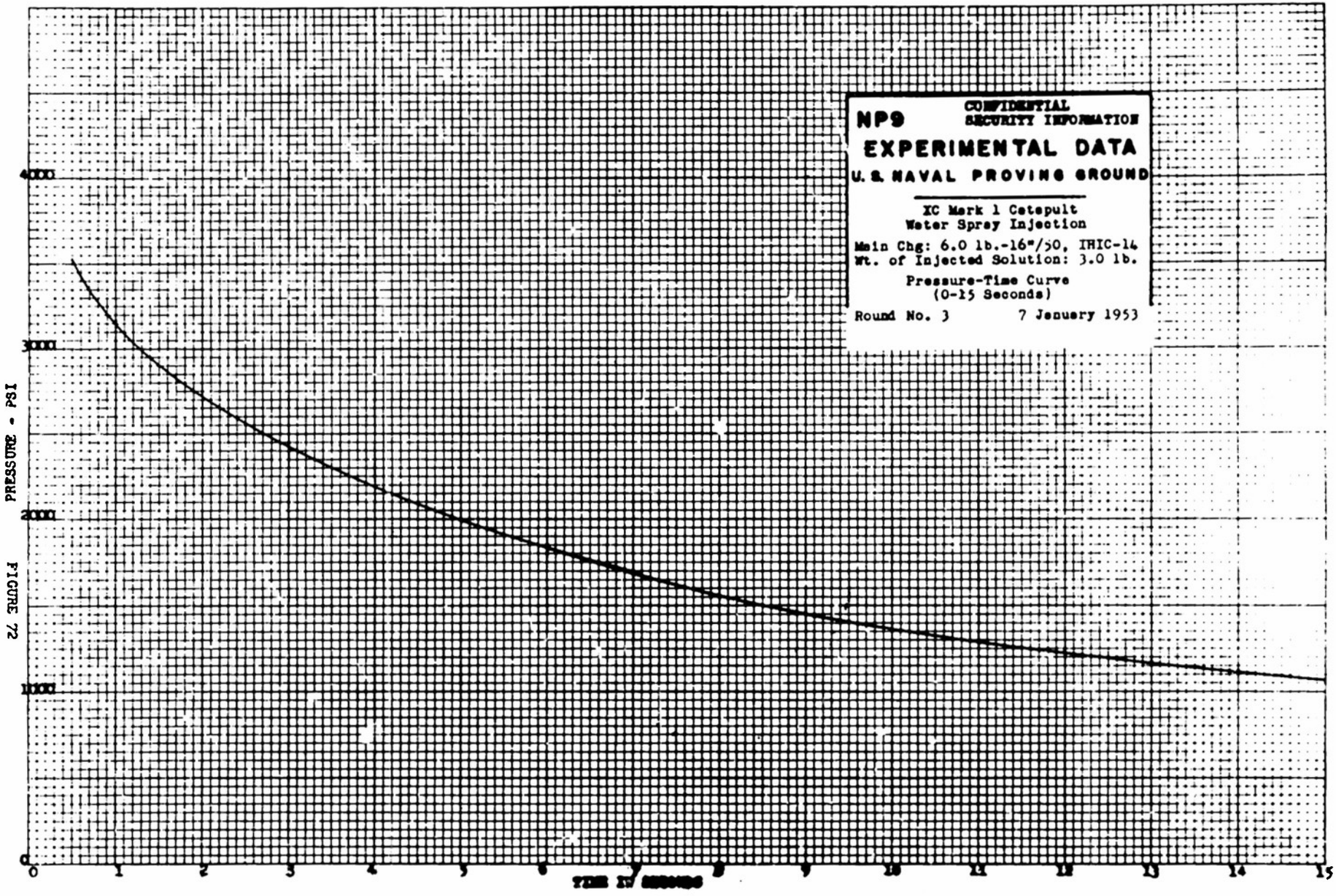

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 3
7 January 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIGURE 72

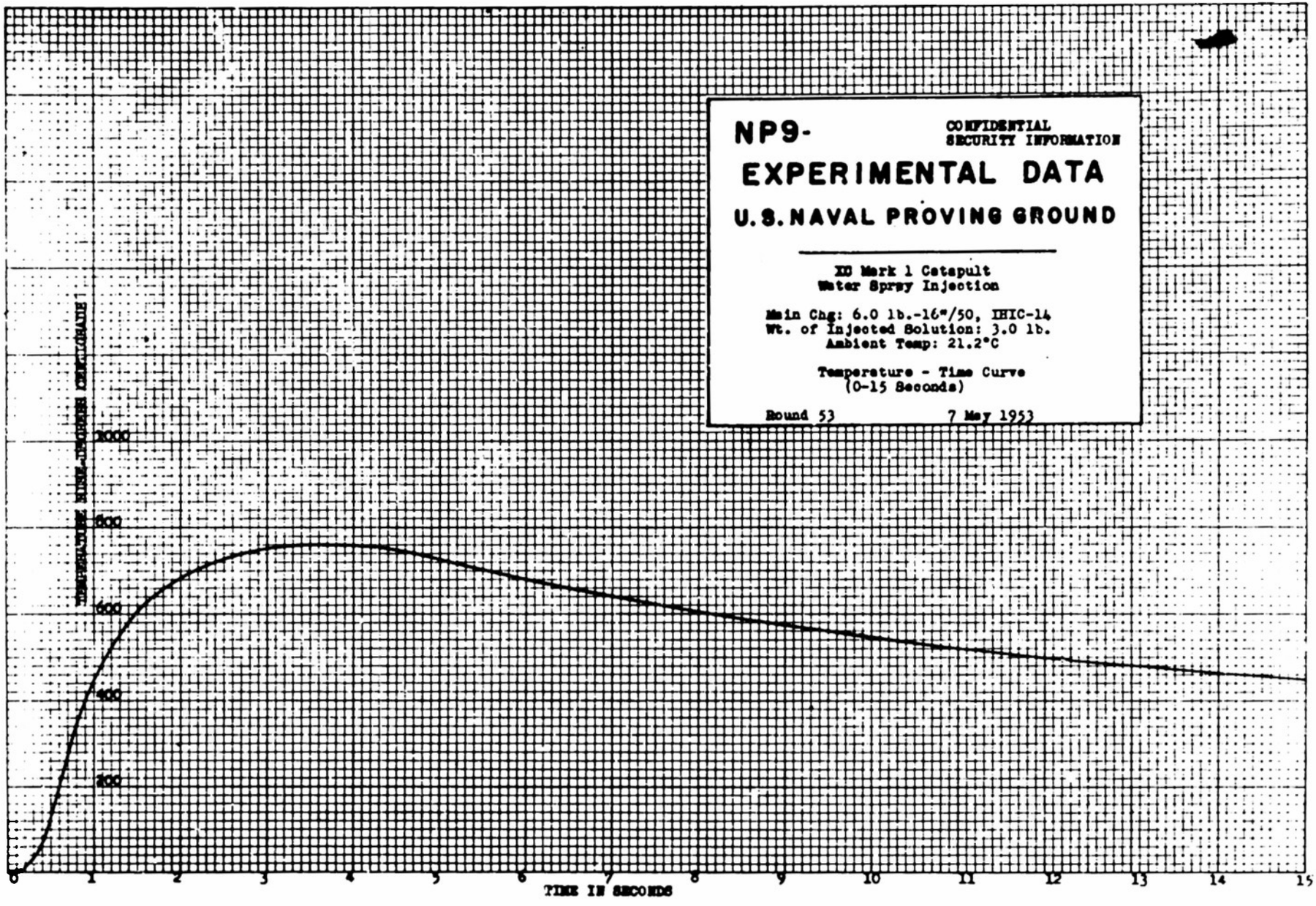

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XS Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 21.2°C
Temperature - Time Curve
(0-15 Seconds)
Round 53
7 May 1953
TEMPERATURE DEGREES FAHRENHEIT
2000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 73

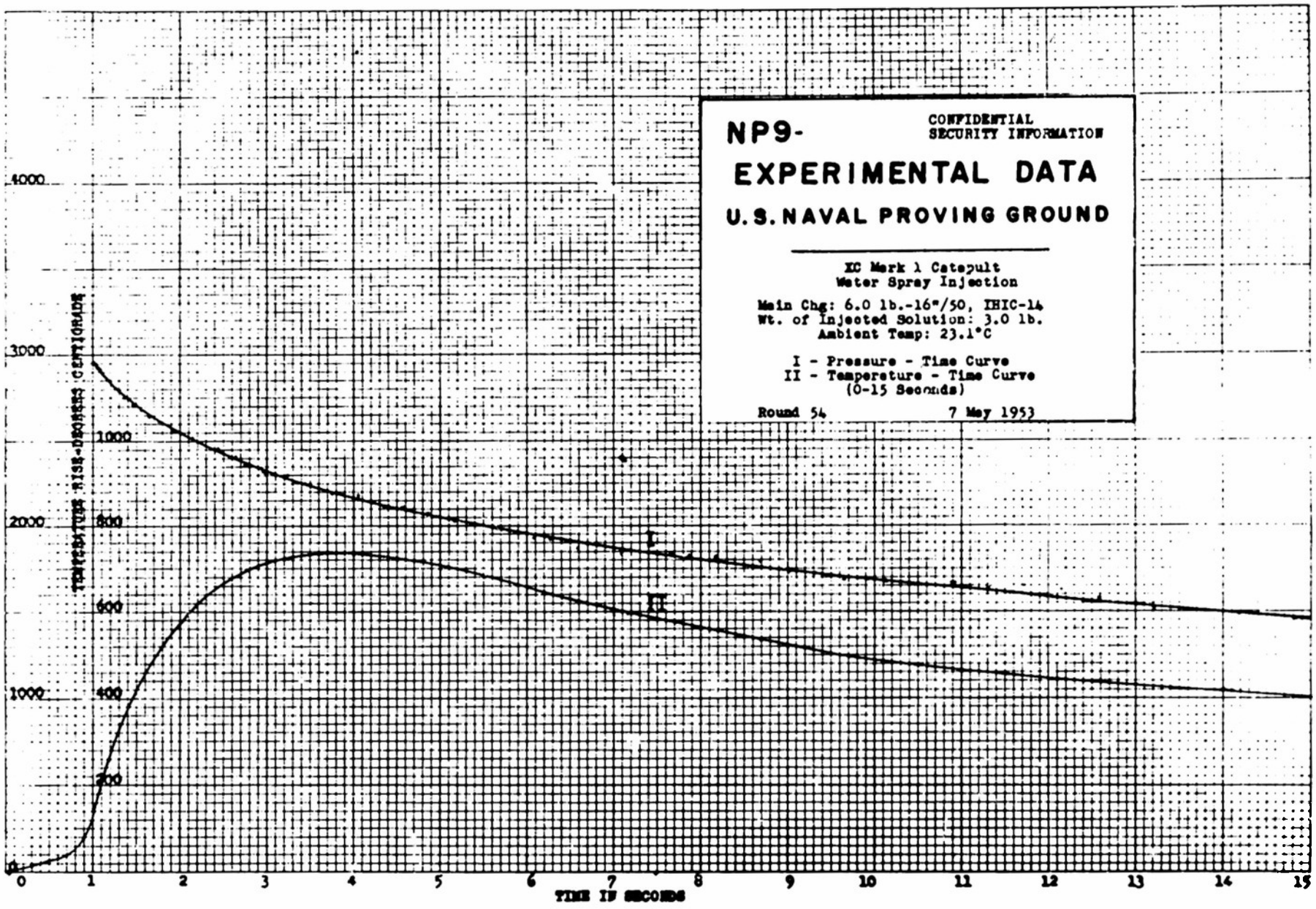

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 23.1°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 54
7 May 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 74

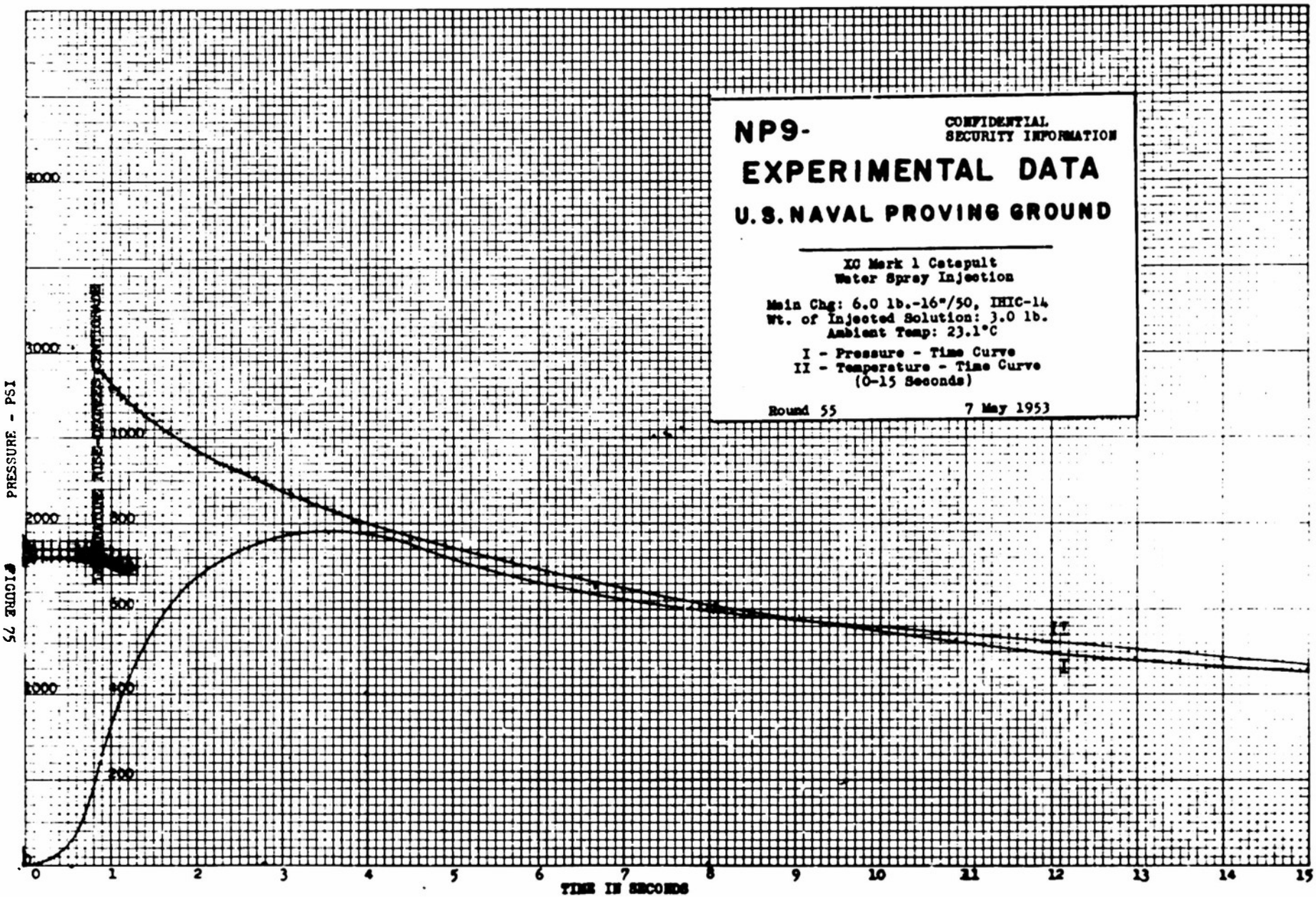

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 23.1°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 55
7 May 1953
PRESSURE - PSI
TIME IN SECONDS
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIGURE 75

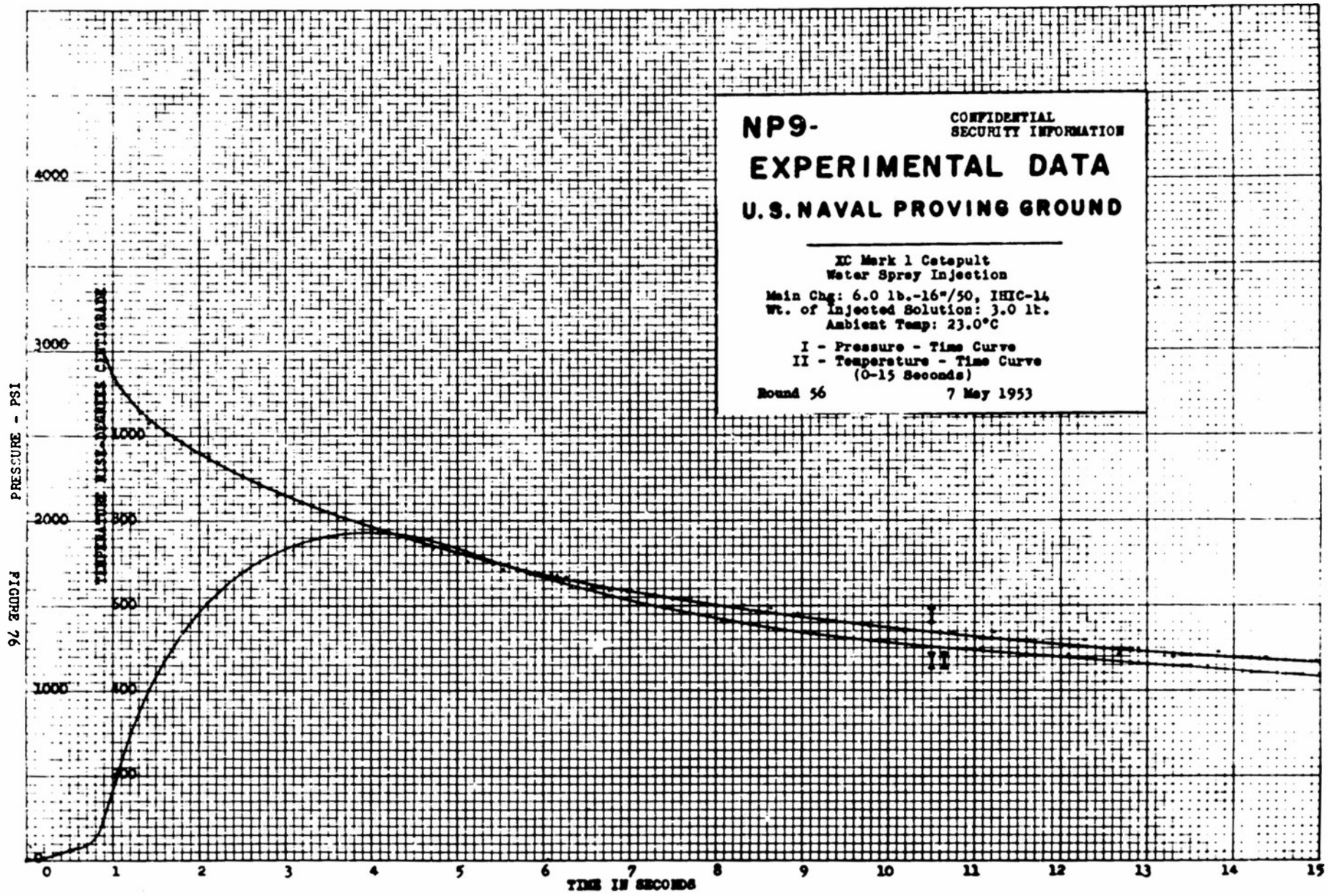

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lt.
Ambient Temp: 23.0°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 56
7 May 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 76

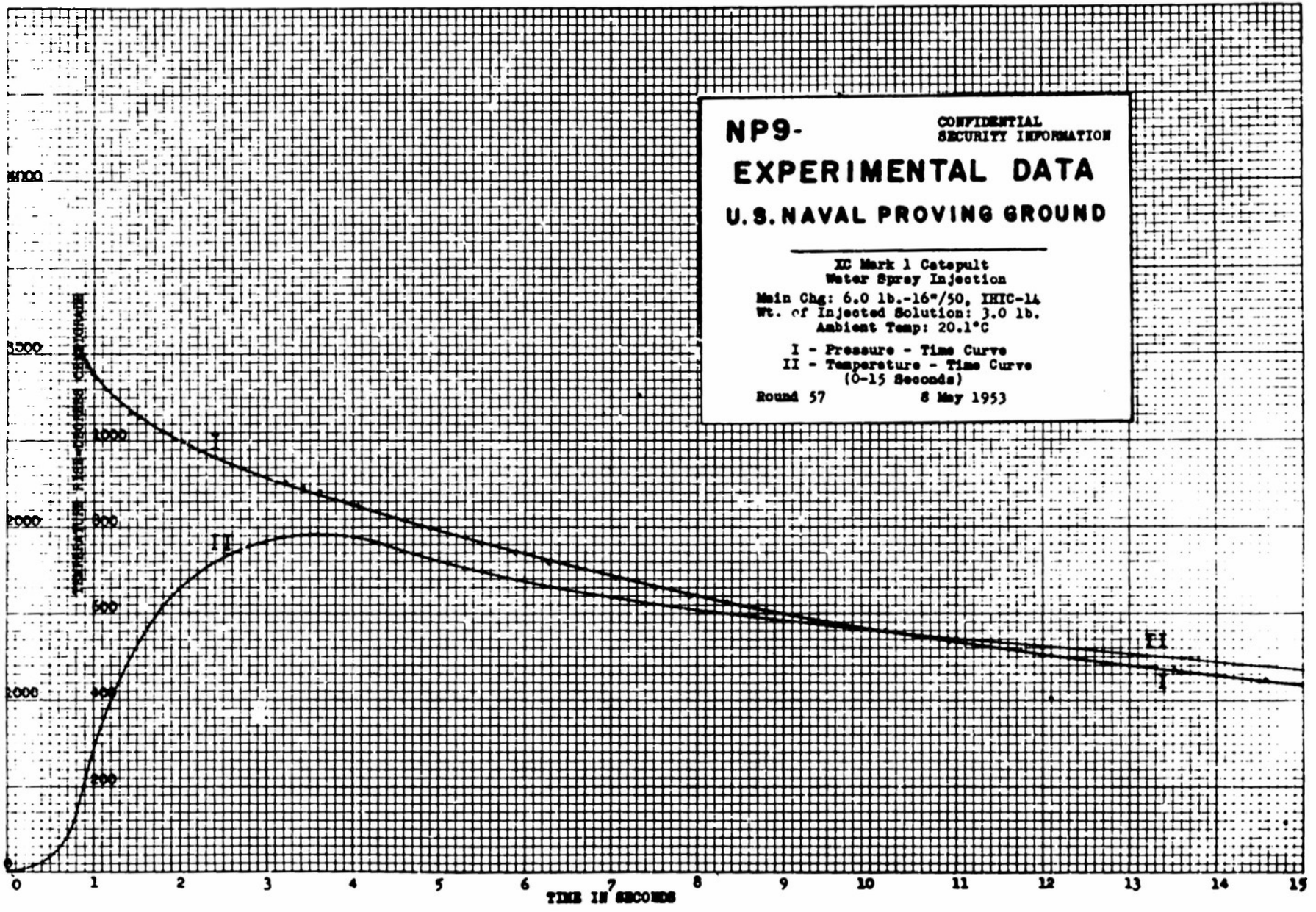

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 20.1°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 57
8 May 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II
FI

FIGURE 77

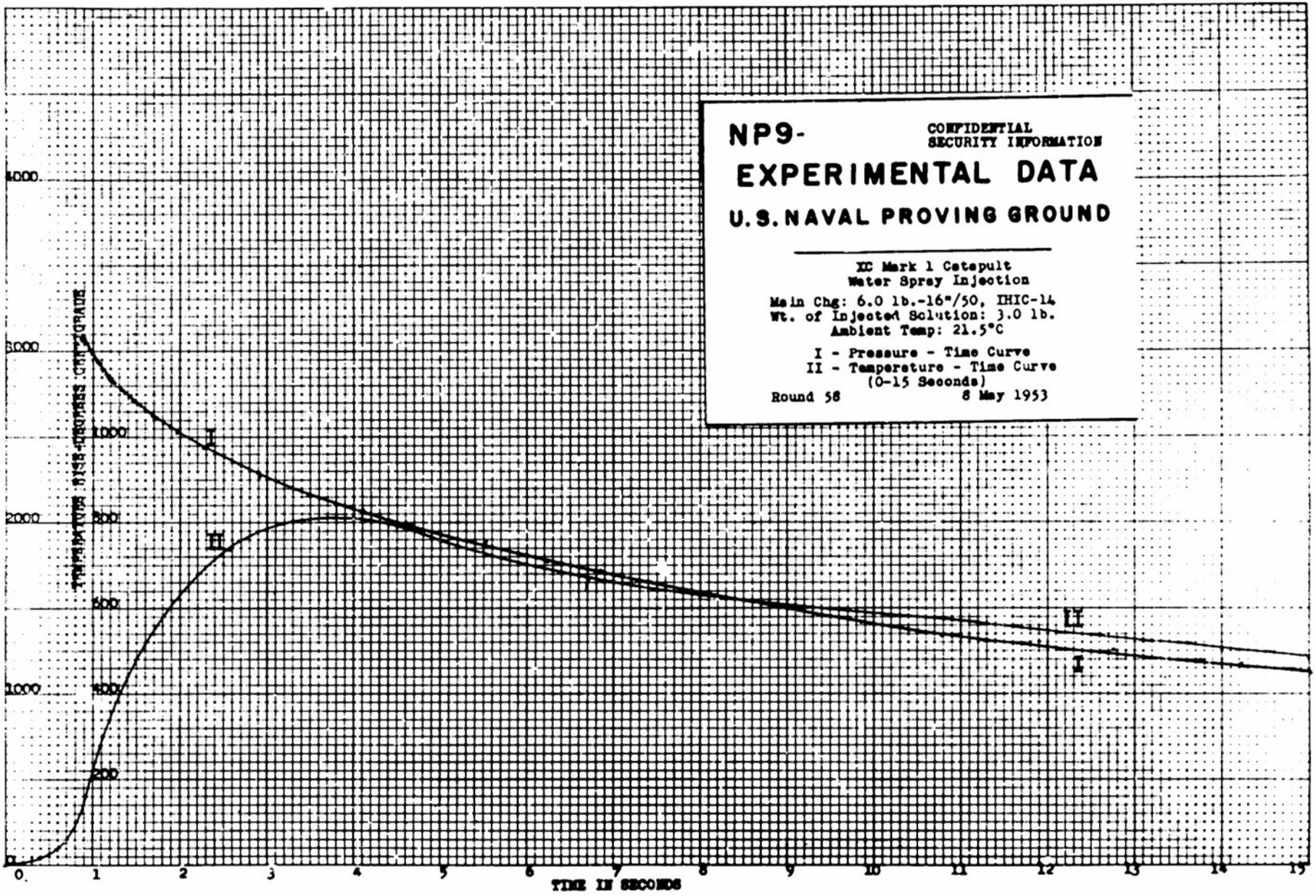

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Water Spray Injection
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 21.5°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 58
8 May 1953
4000
3000
2000
1000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS
I
II

FIGURE 78

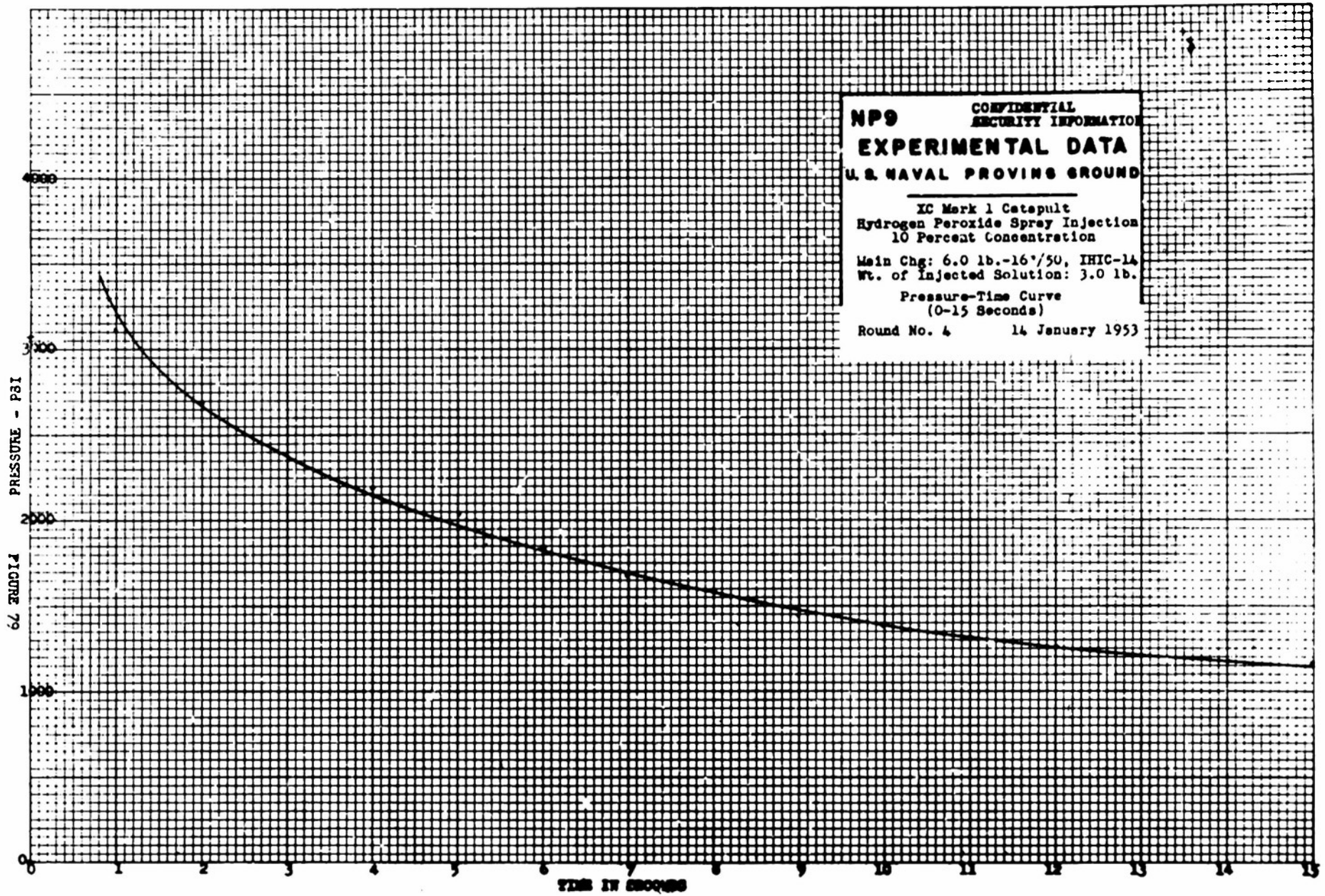

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16°/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 4 14 January 1953
PRESSURE - PSI
TIME IN SECONDS
0
1000
2000
3000
4000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIGURE 79

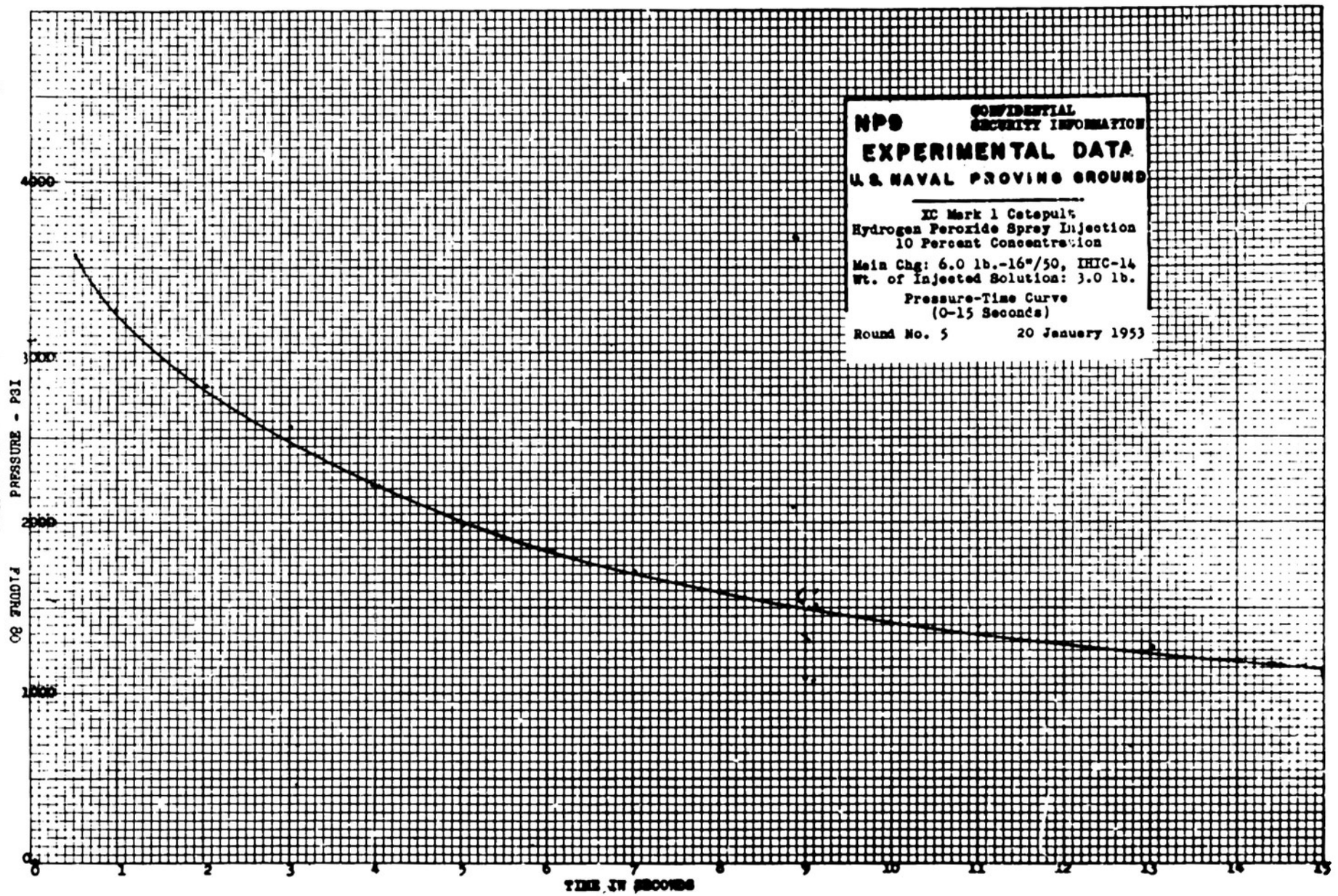

NPG
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 5
20 January 1953
4000
3000
2000
1000
0
PRESSURE - PSI
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 80

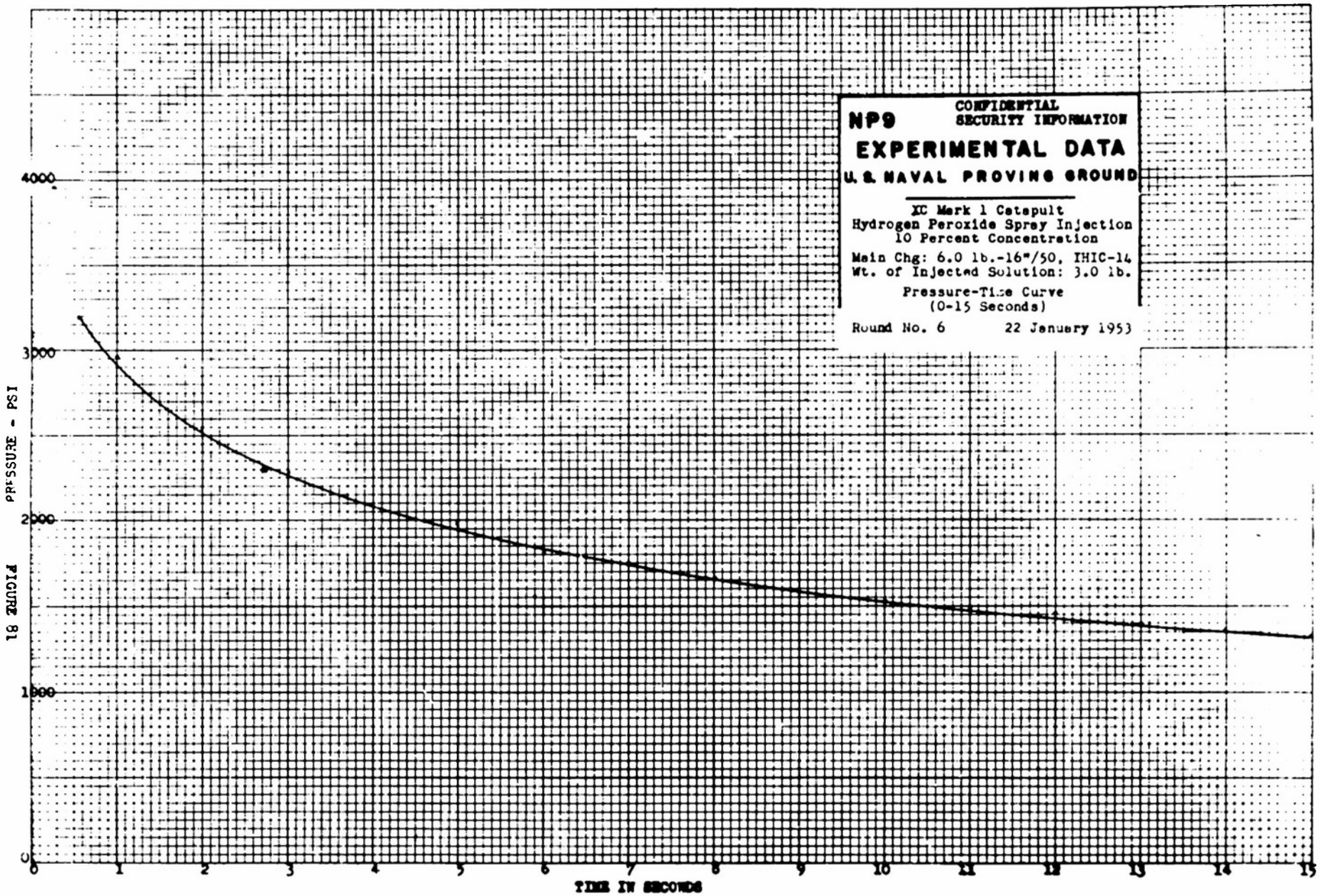

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 6 22 January 1953
PRESSURE - PSI
0
1000
2000
3000
4000
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 81

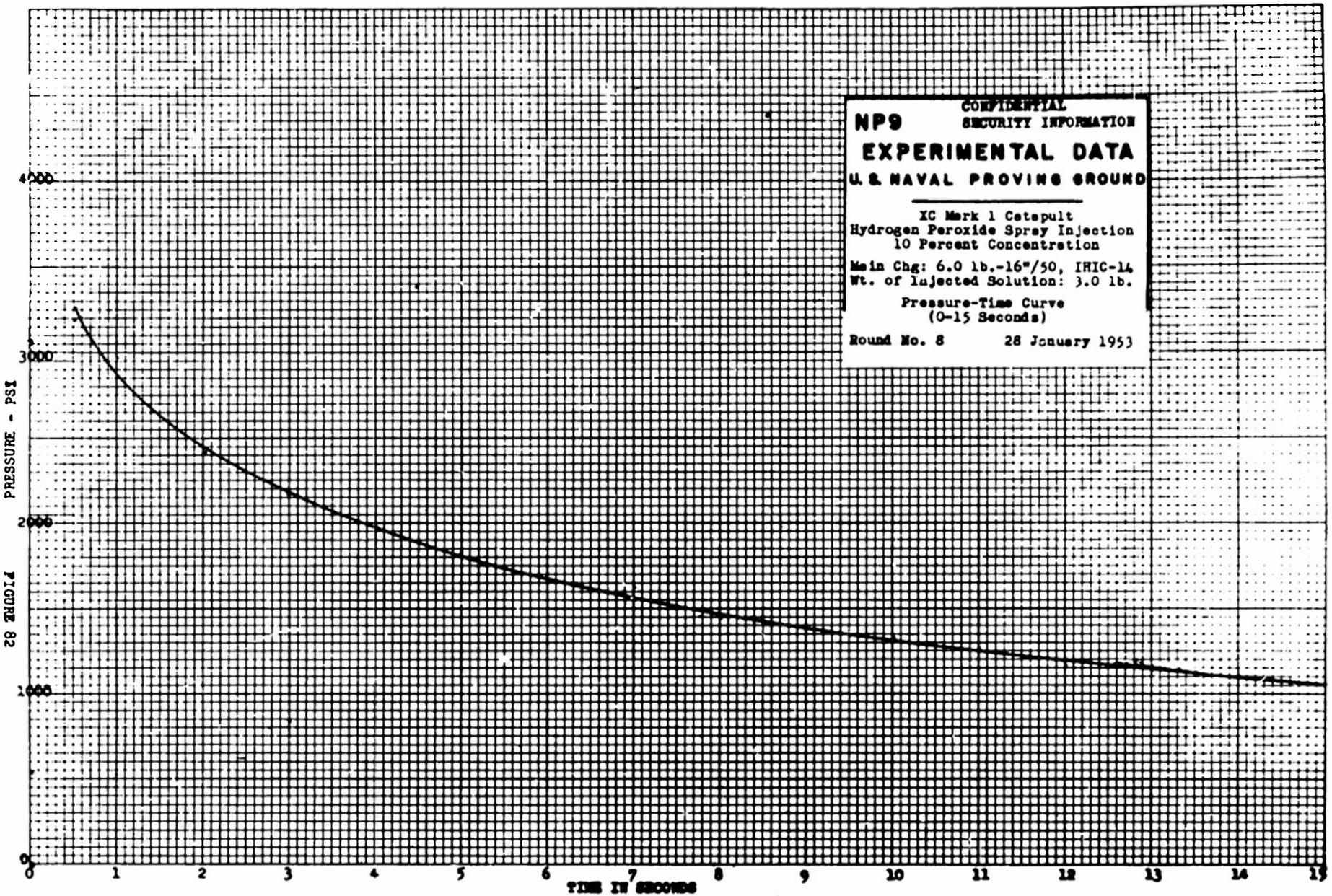

CONFIDENTIAL
SECURITY INFORMATION
NP9
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 8 28 January 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TIME IN SECONDS

FIGURE 82

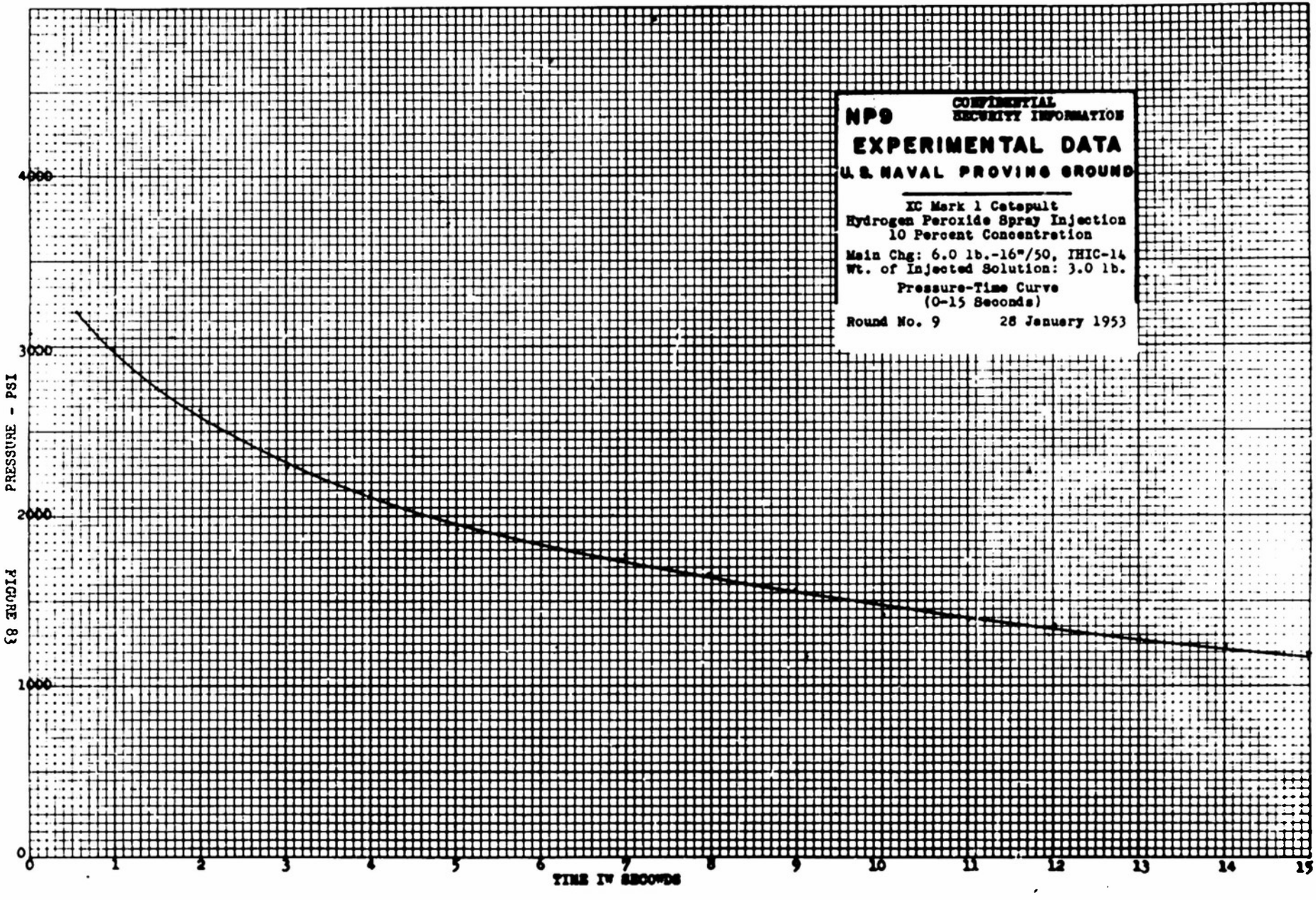

CONFIDENTIAL
SECURITY INFORMATION
NPG
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 9 28 January 1953
PRESSURE - PSI
0
1000
2000
3000
4000
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TIME IN SECONDS

FIGURE 83

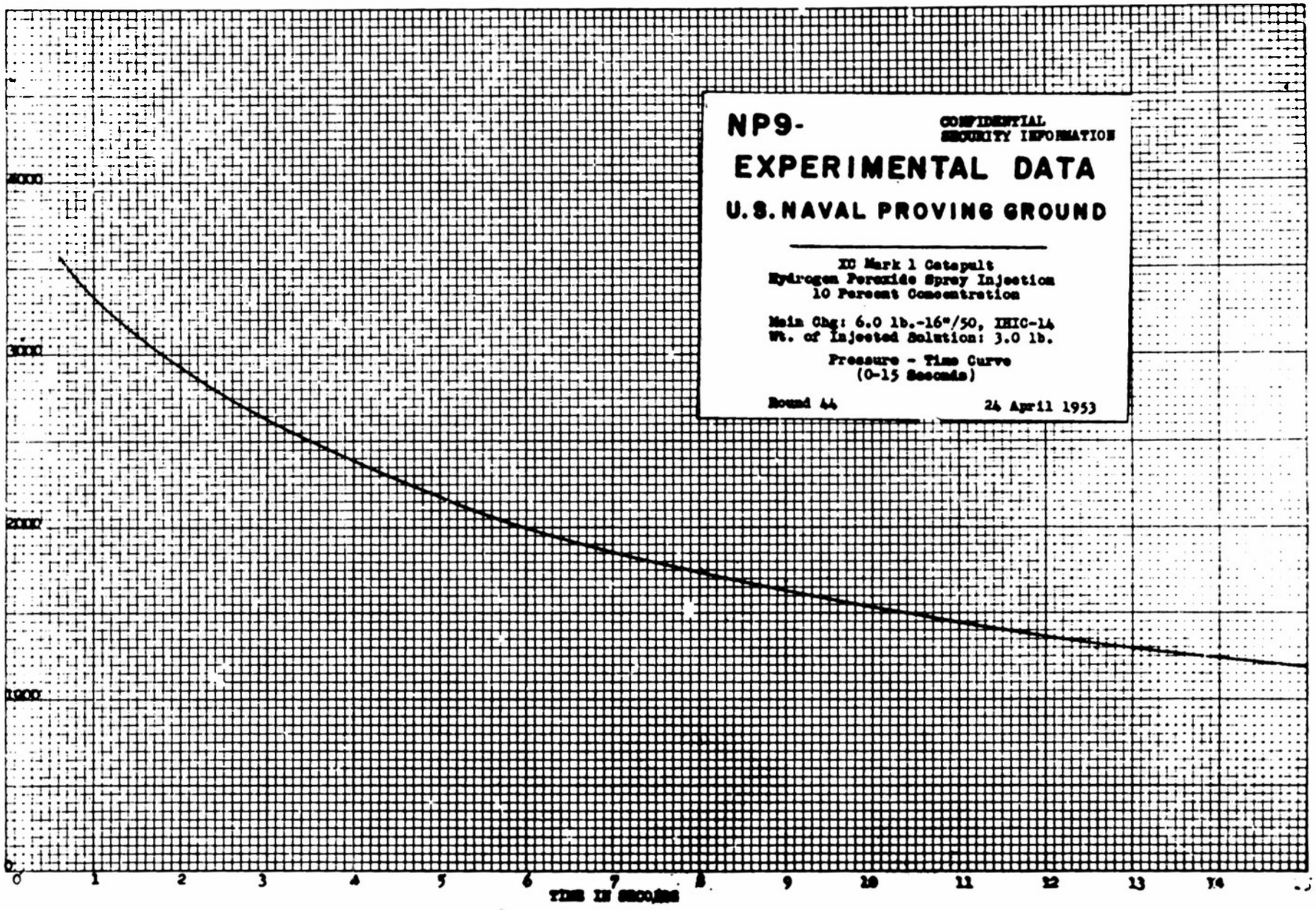
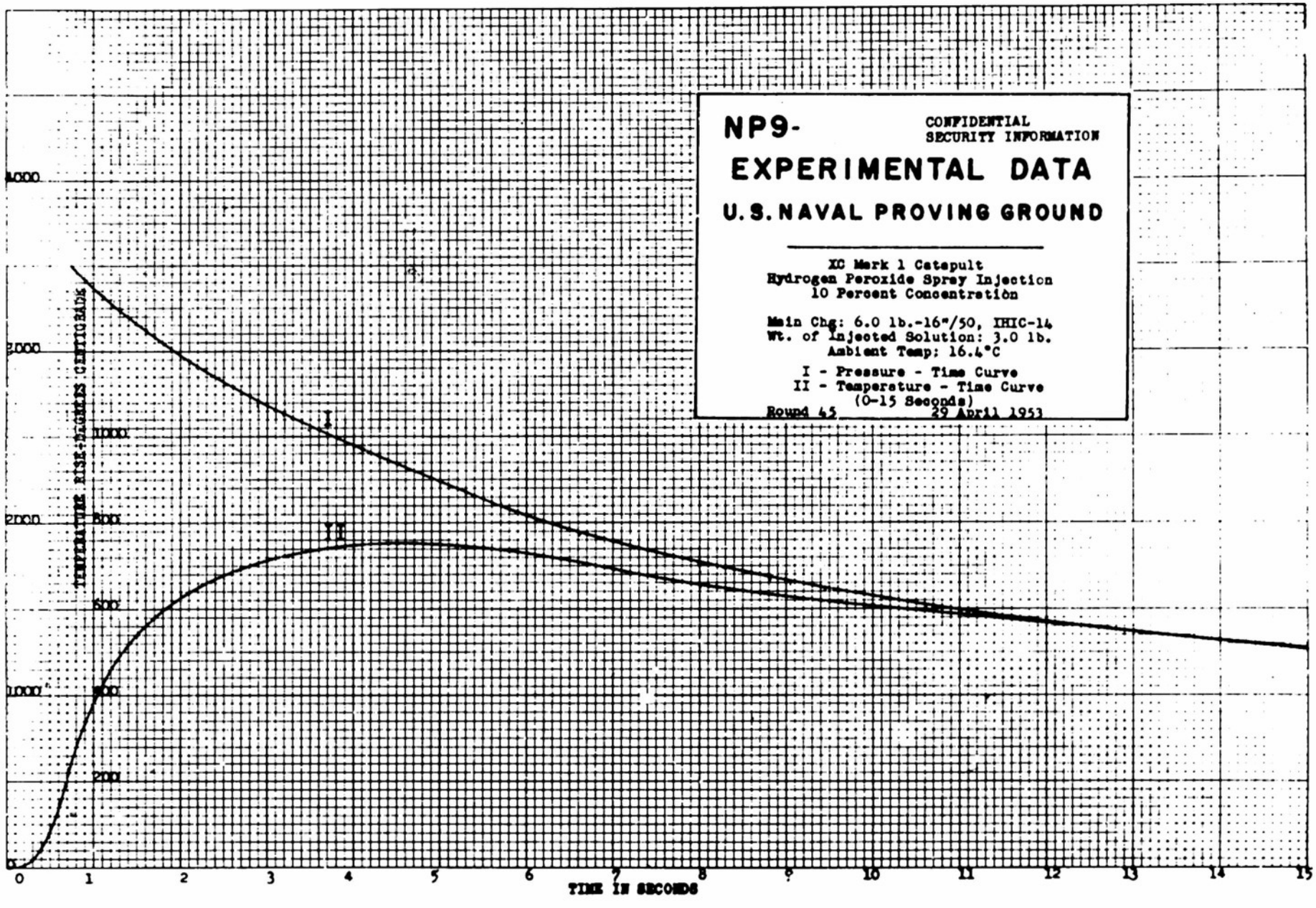

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure - Time Curve
(0-15 Seconds)
Round 44
24 April 1953
PRESSURE - PSI
TIME IN SECONDS
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14

FIGURE 64


NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 16.4°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 45
29 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

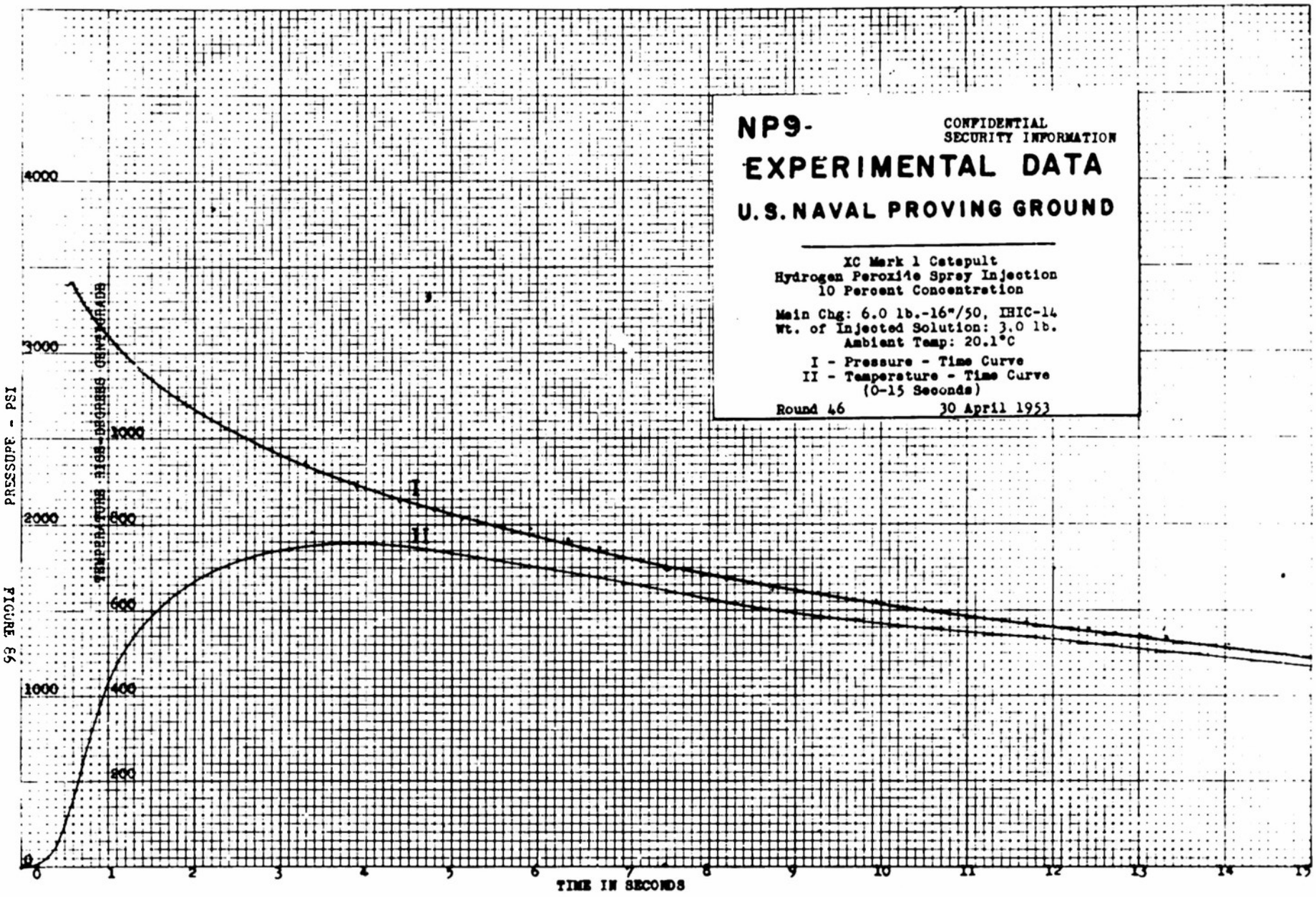

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
10 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 20.1°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 46
30 April 1953
PRESSURE - PSI
TEMPERATURE - DEGREES FAHRENHEIT
TIME IN SECONDS
I
II

FIGURE 65

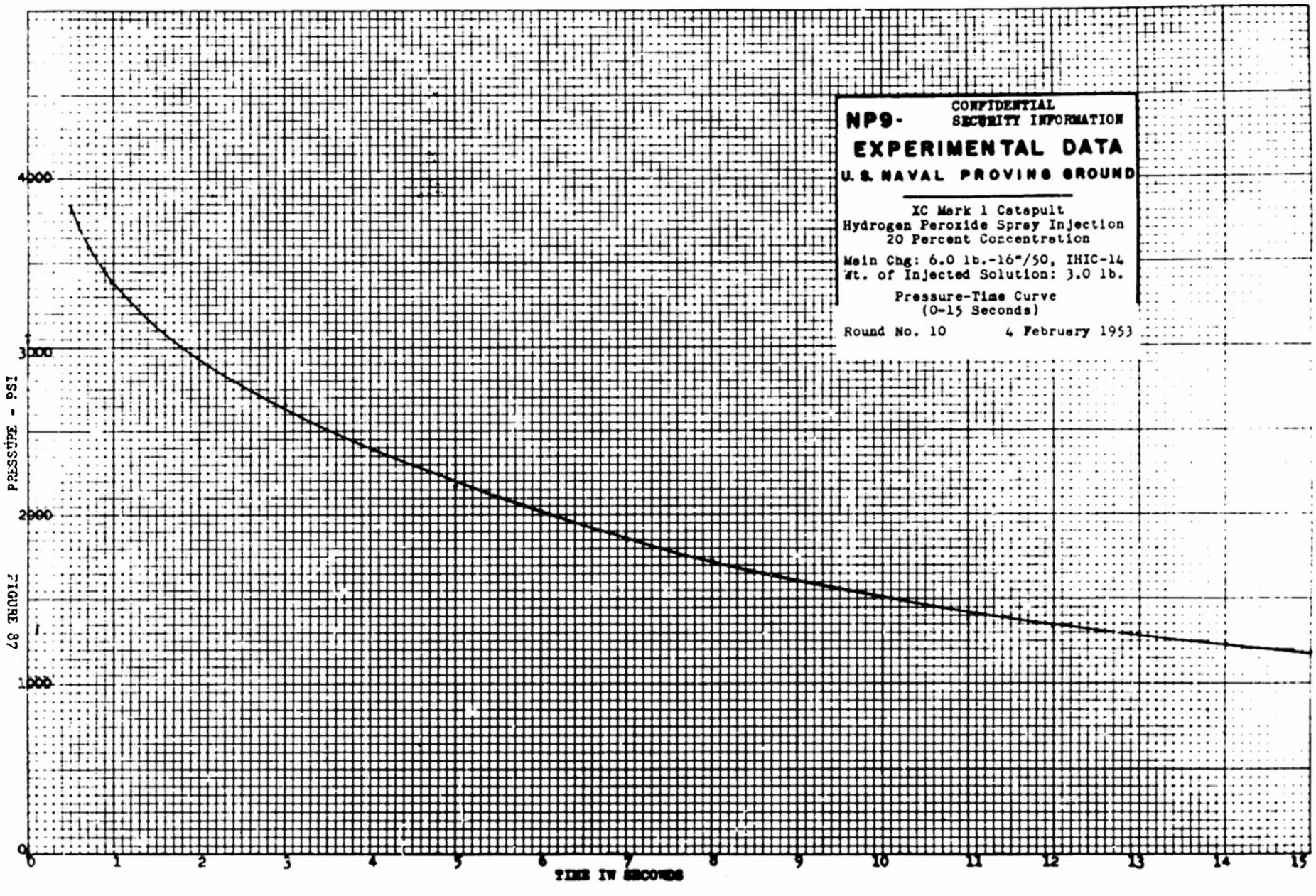

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 10
4 February 1953
PRESSURE - PSI
0
1000
2000
3000
4000
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 87

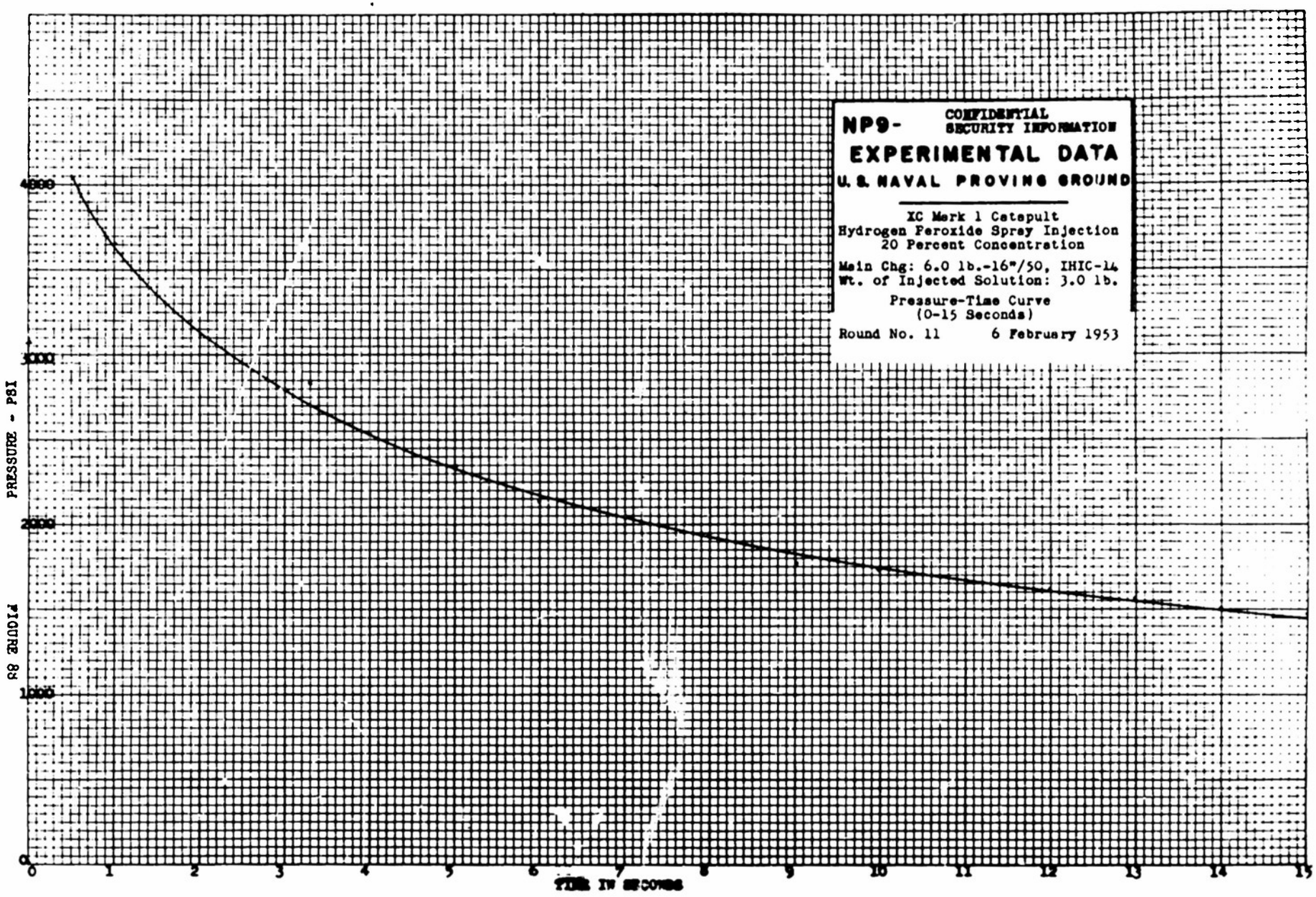

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 11 6 February 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 88

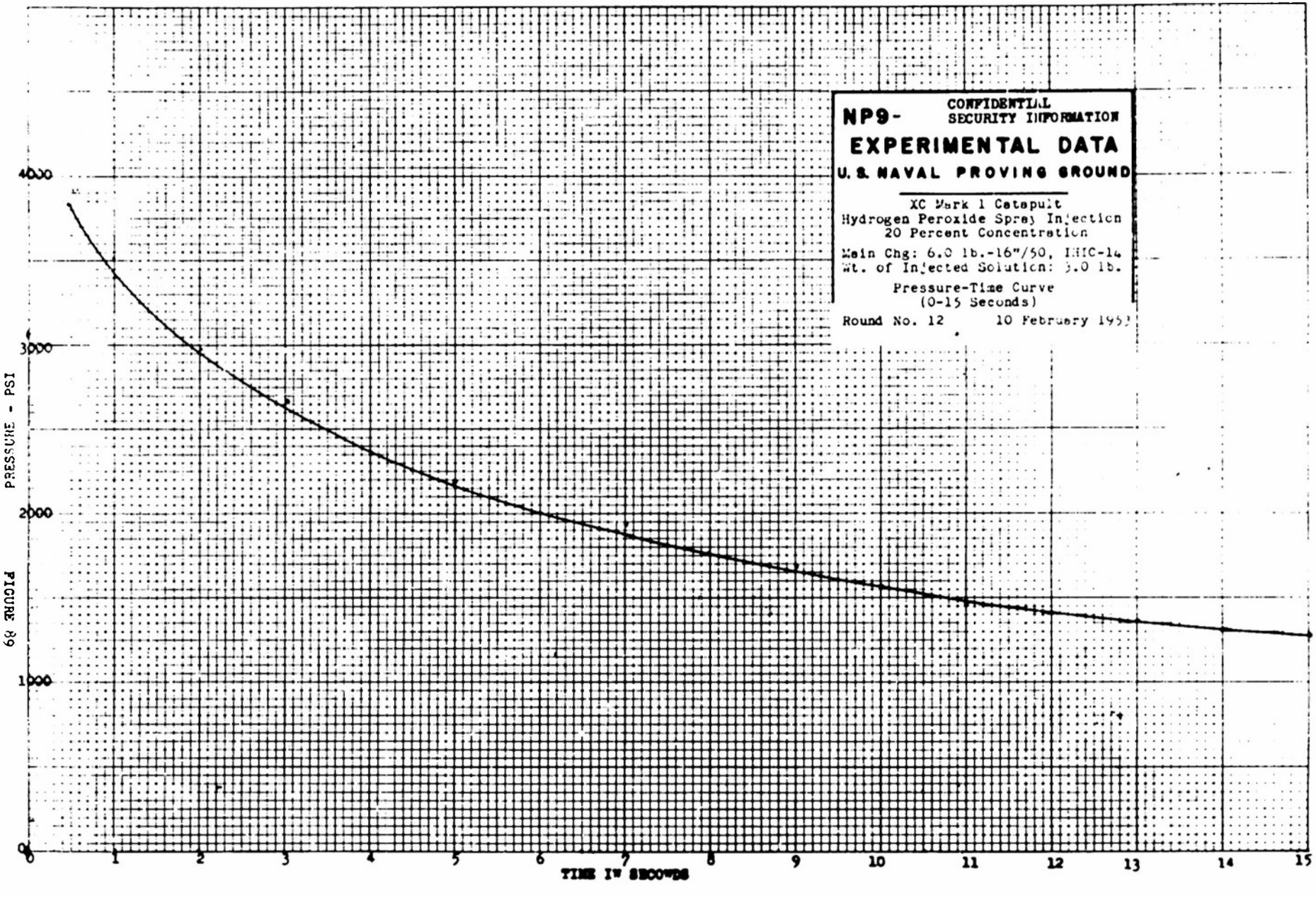

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IMR-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 12
10 February 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 89

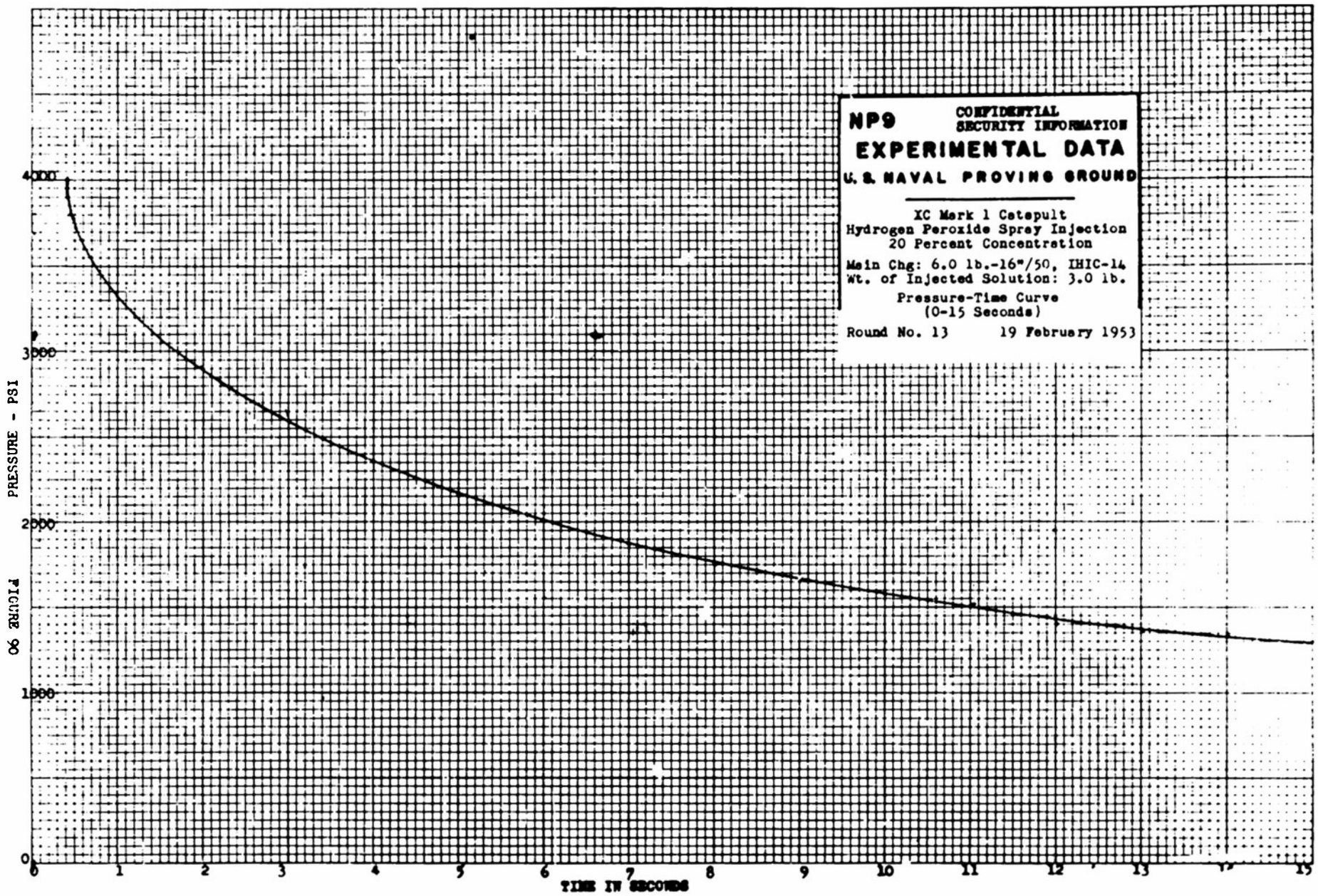

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 13 19 February 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
15
TIME IN SECONDS

FIGURE 90

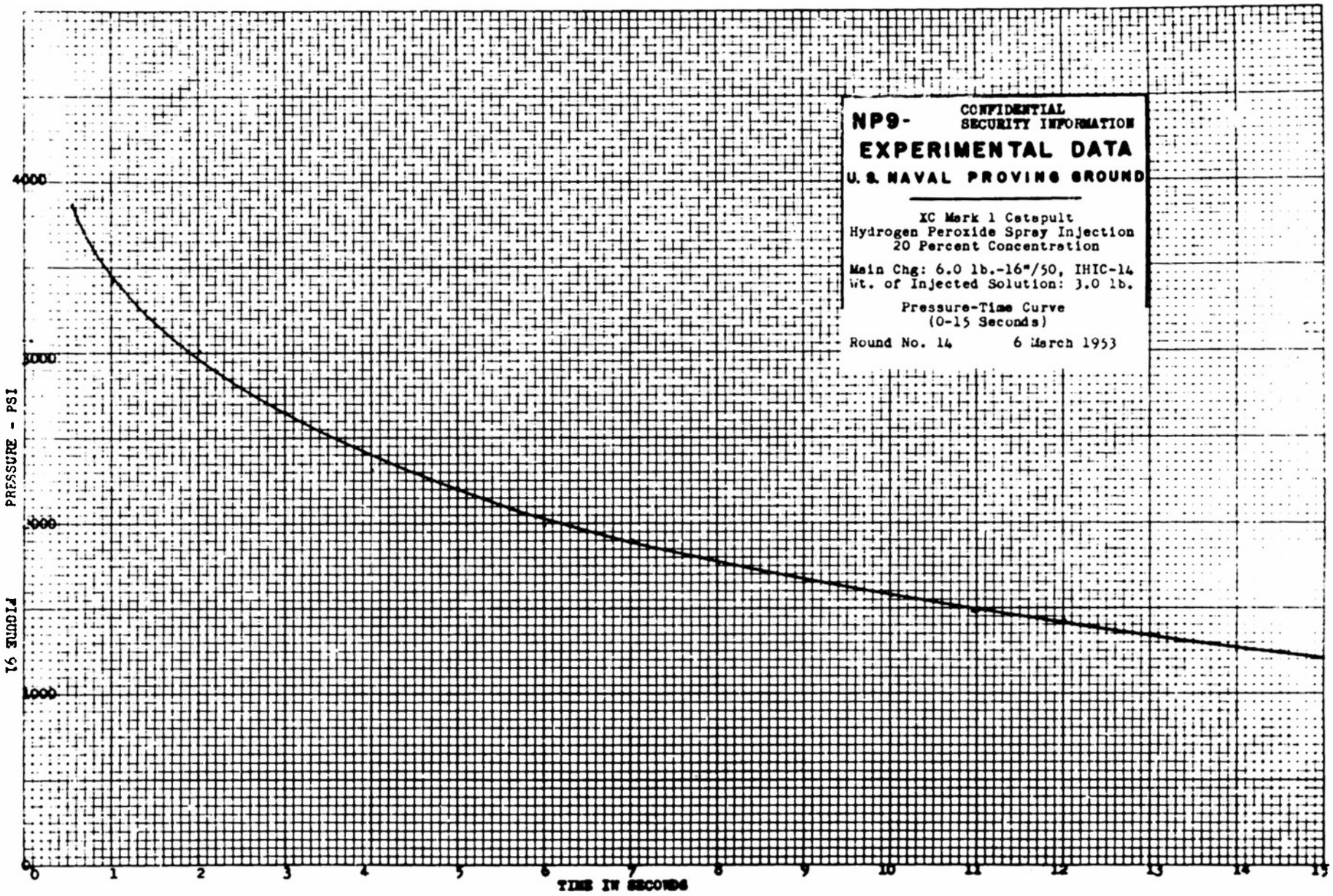

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 14 6 March 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TIME IN SECONDS

FIGURE 91

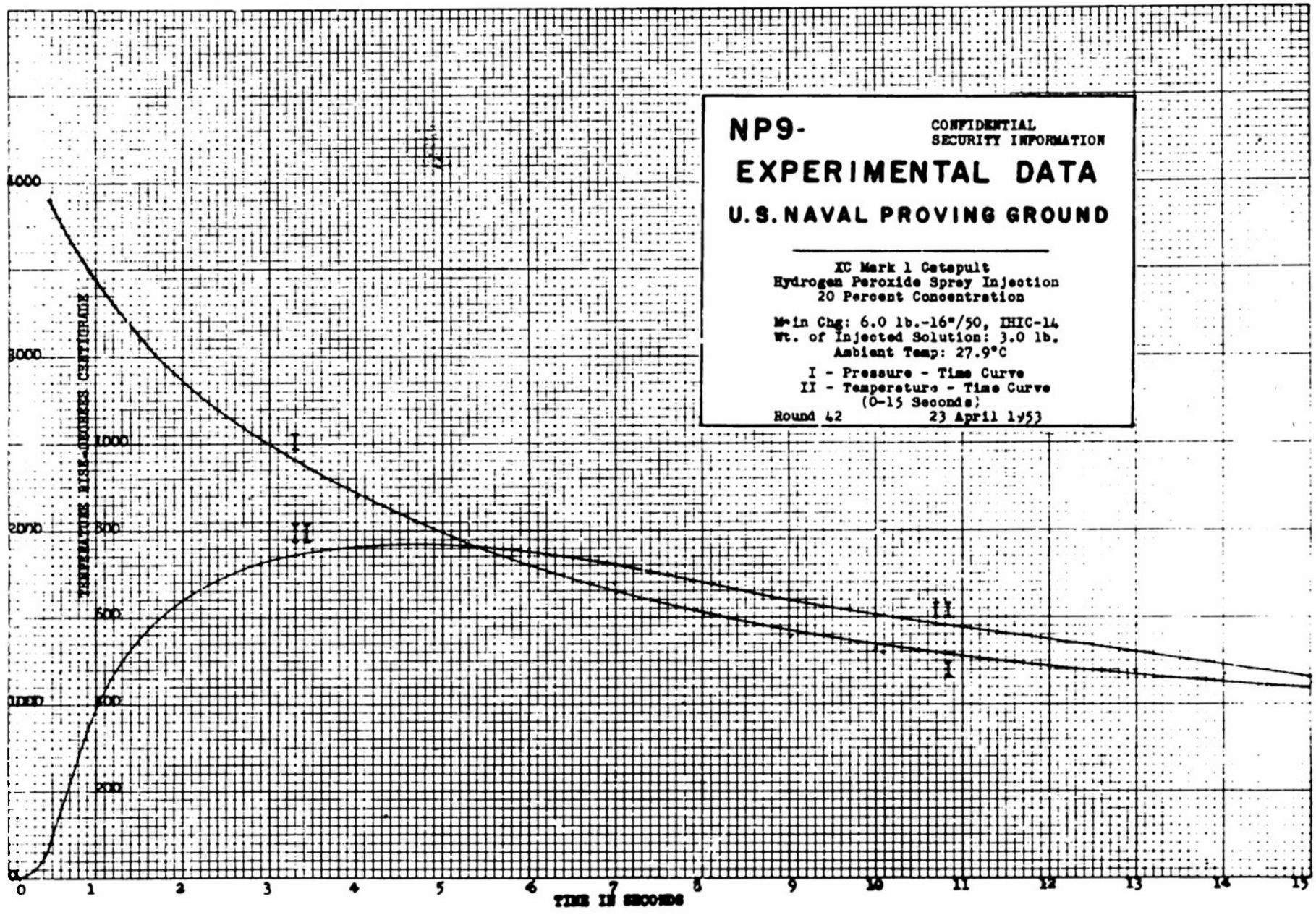

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 27.9°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 42 23 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 92

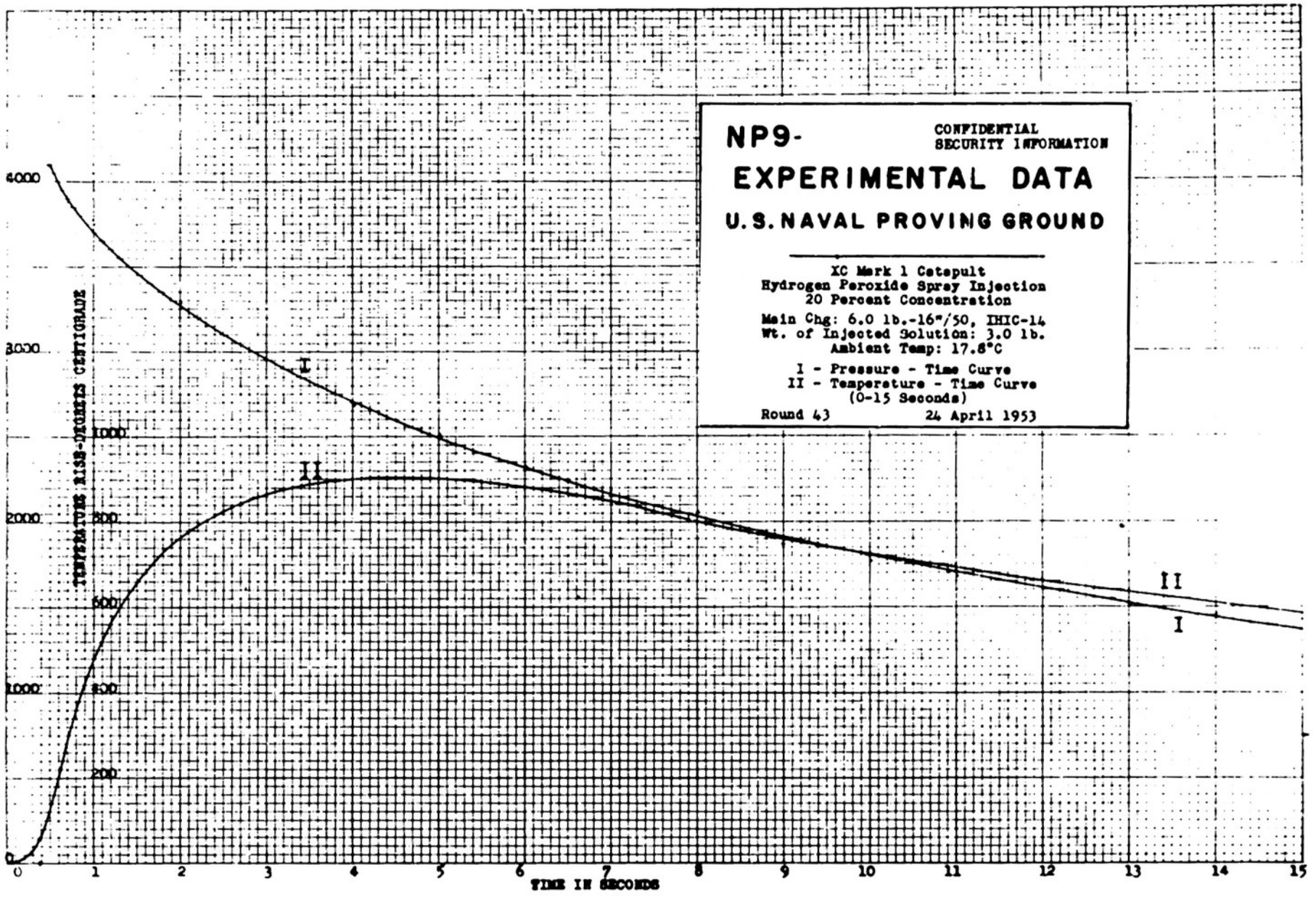

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
20 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 17.8°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 43
24 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
4000
3000
2000
1000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II
II
I

FIGURE 93

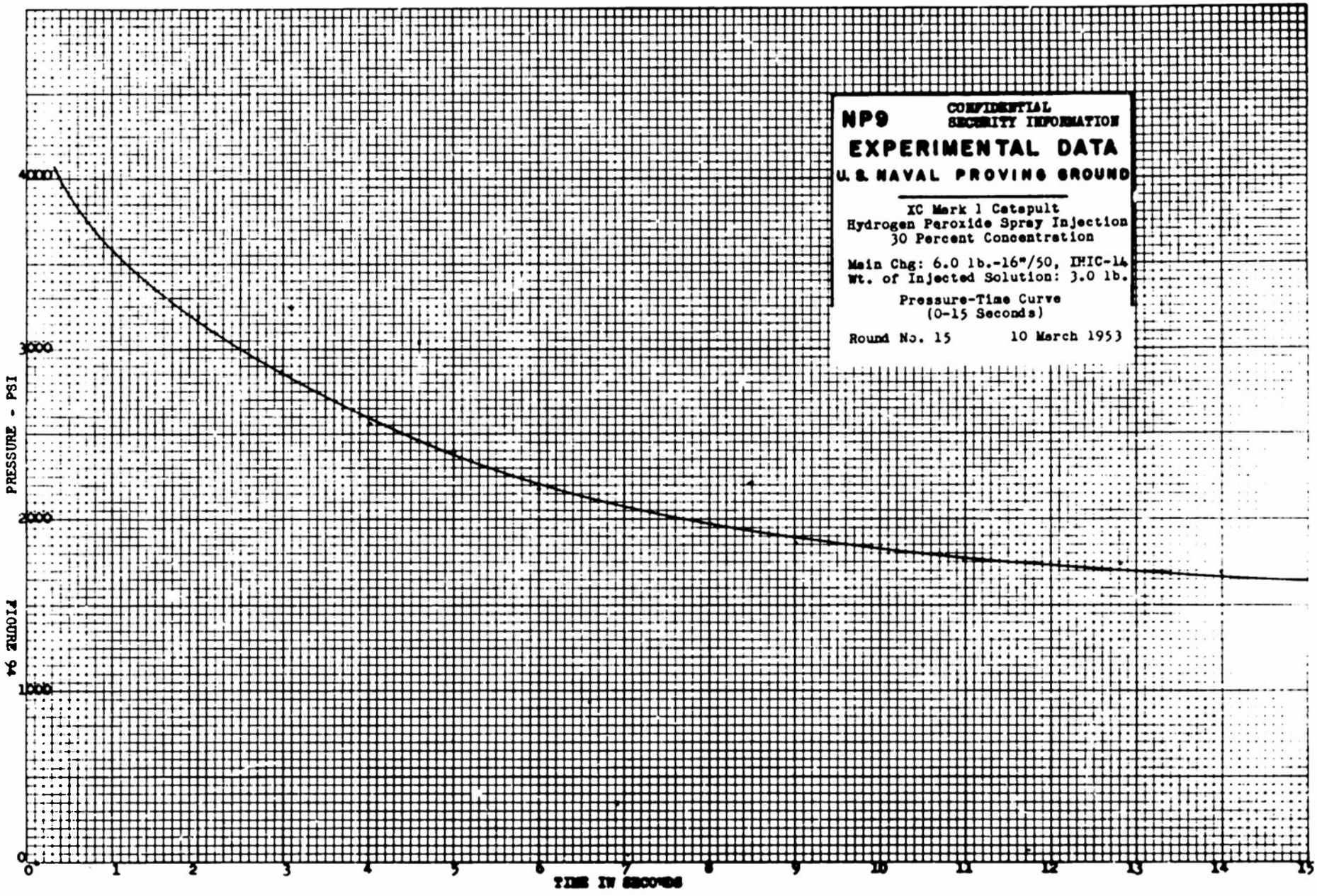

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IMIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 15
10 March 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TIME IN SECONDS

FIGURE 94

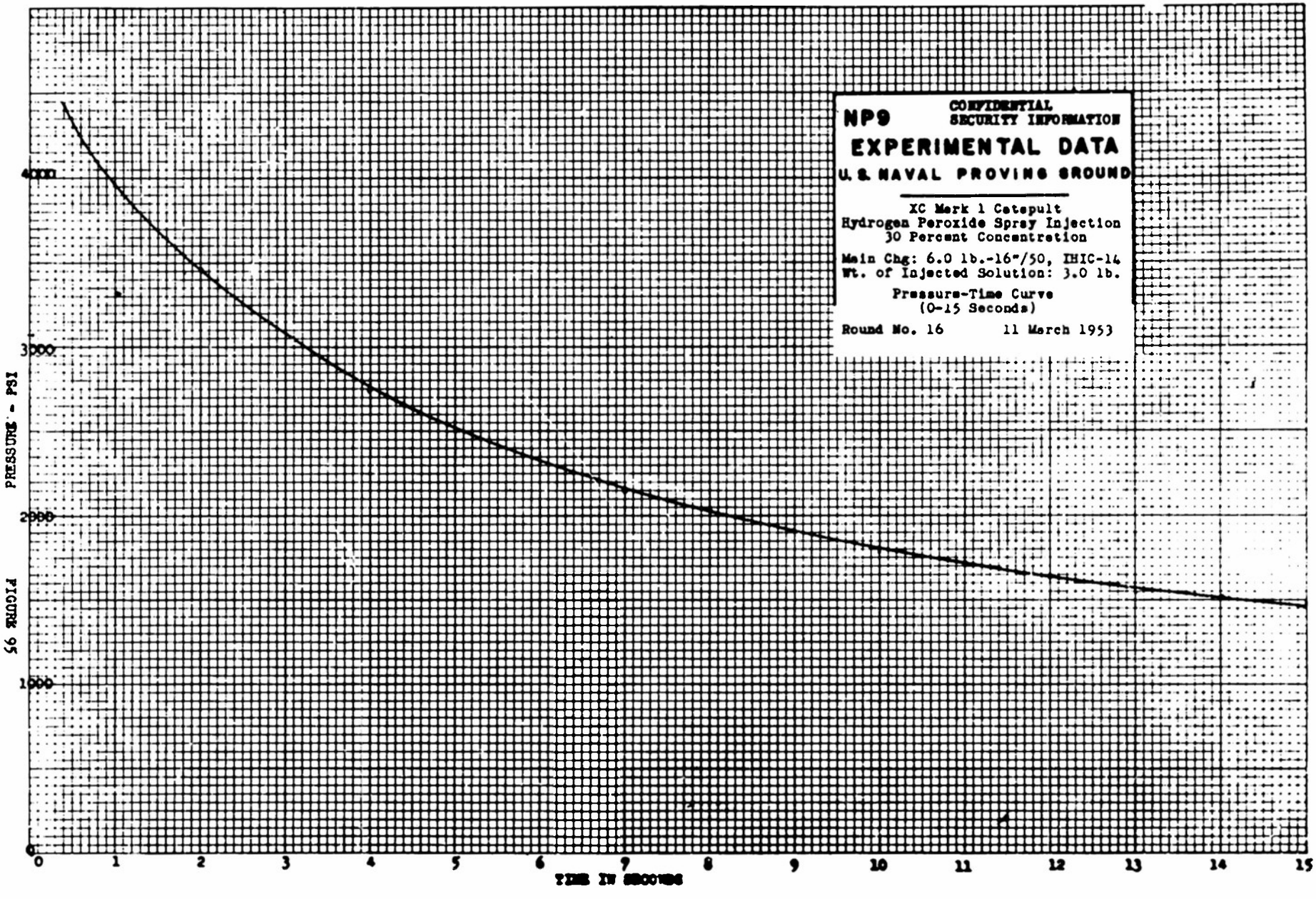

NP9
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Pressure-Time Curve
(0-15 Seconds)
Round No. 16 11 March 1953
PRESSURE - PSI
4000
3000
2000
1000
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TIME IN SECONDS

FIGURE 95

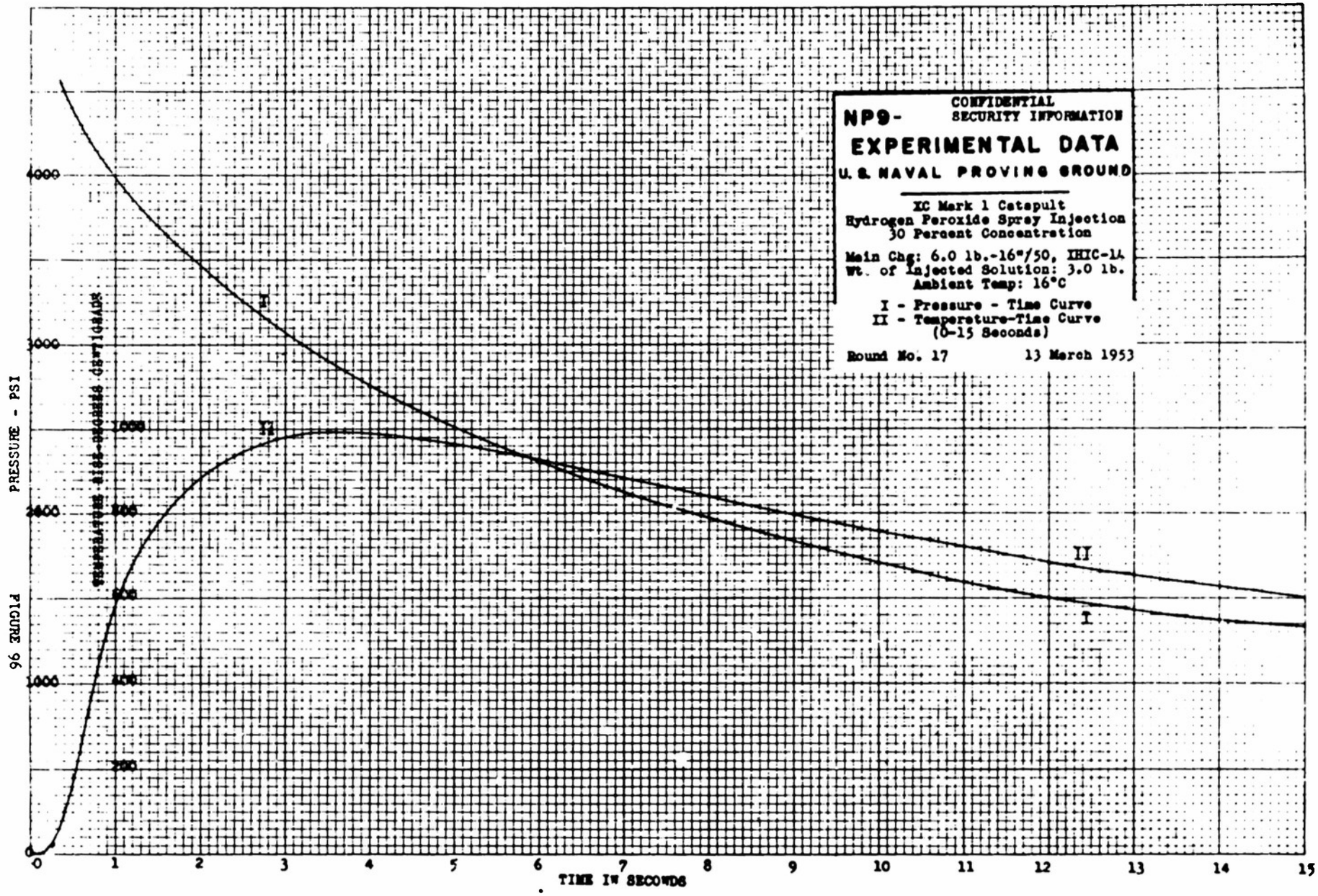

CONFIDENTIAL
SECURITY INFORMATION
NP9-
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 16°C
I - Pressure - Time Curve
II - Temperature-Time Curve
(0-15 Seconds)
Round No. 17
13 March 1953
PRESSURE - PSI
TEMPERATURE - DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 96

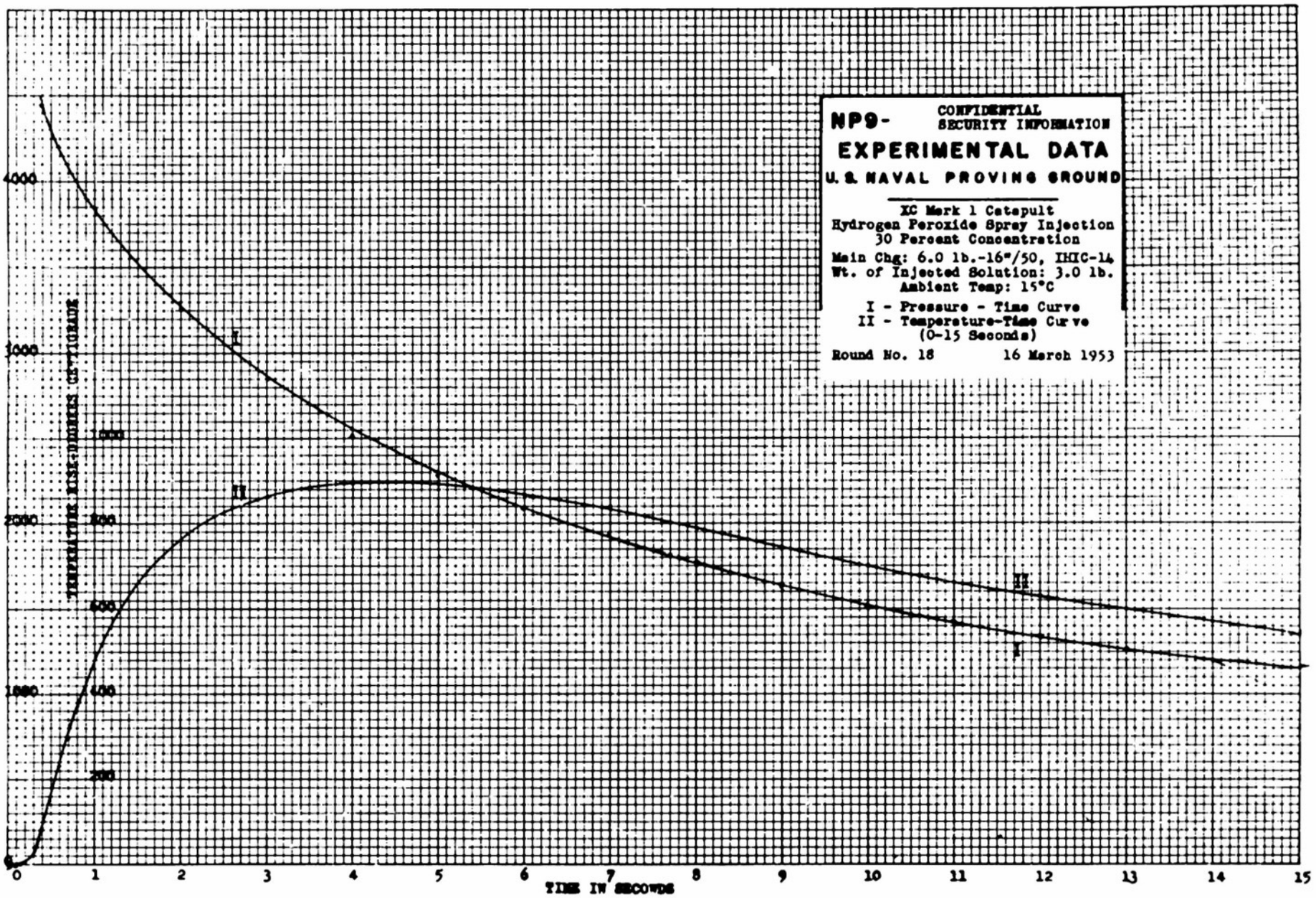

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 15°C
I - Pressure - Time Curve
II - Temperature-Time Curve
(0-15 Seconds)
Round No. 18
16 March 1953
PRESSURE - PSI
TEMPERATURE IN DEGREES CENTIGRADE
TIME IN SECONDS
4000
3000
2000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 97

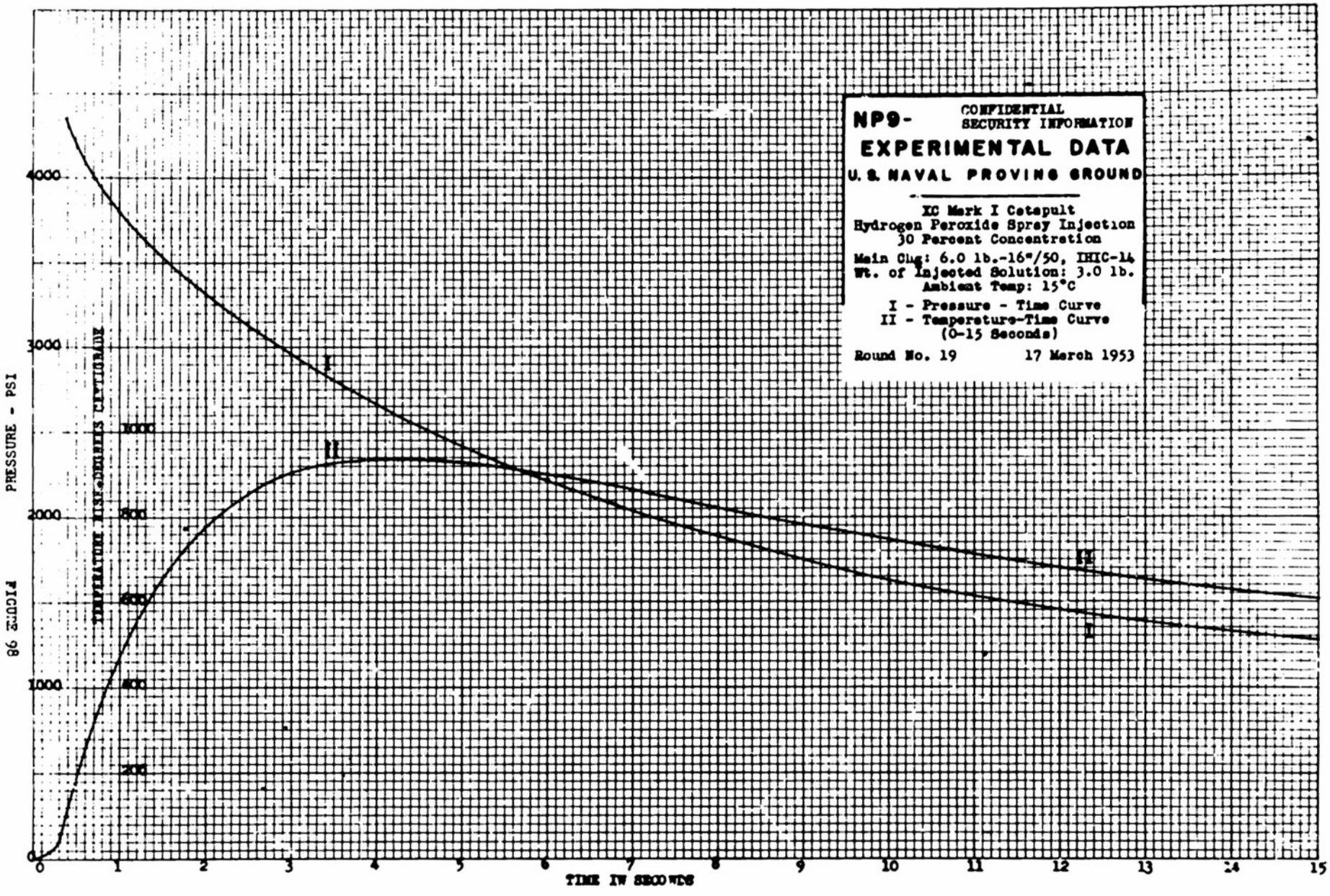

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U. S. NAVAL PROVING GROUND
XC Mark I Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 15°C
I - Pressure - Time Curve
II - Temperature-Time Curve
(0-15 Seconds)
Round No. 19
17 March 1953
PRESSURE - PSI
TEMPERATURE DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 98

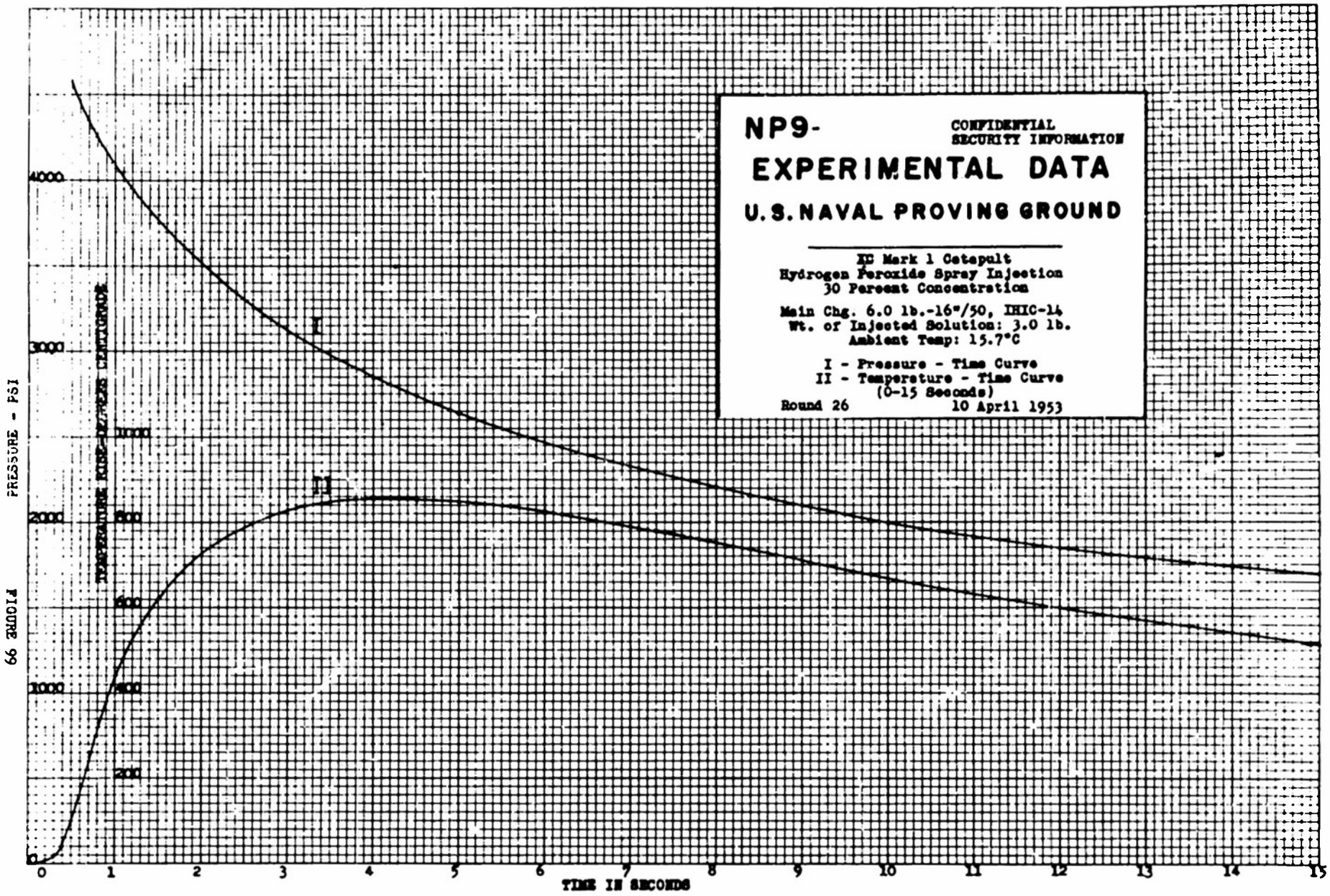

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XE Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg. 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 15.7°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 26
10 April 1953
PRESSURE - PSI
TEMPERATURE RISE - DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 99

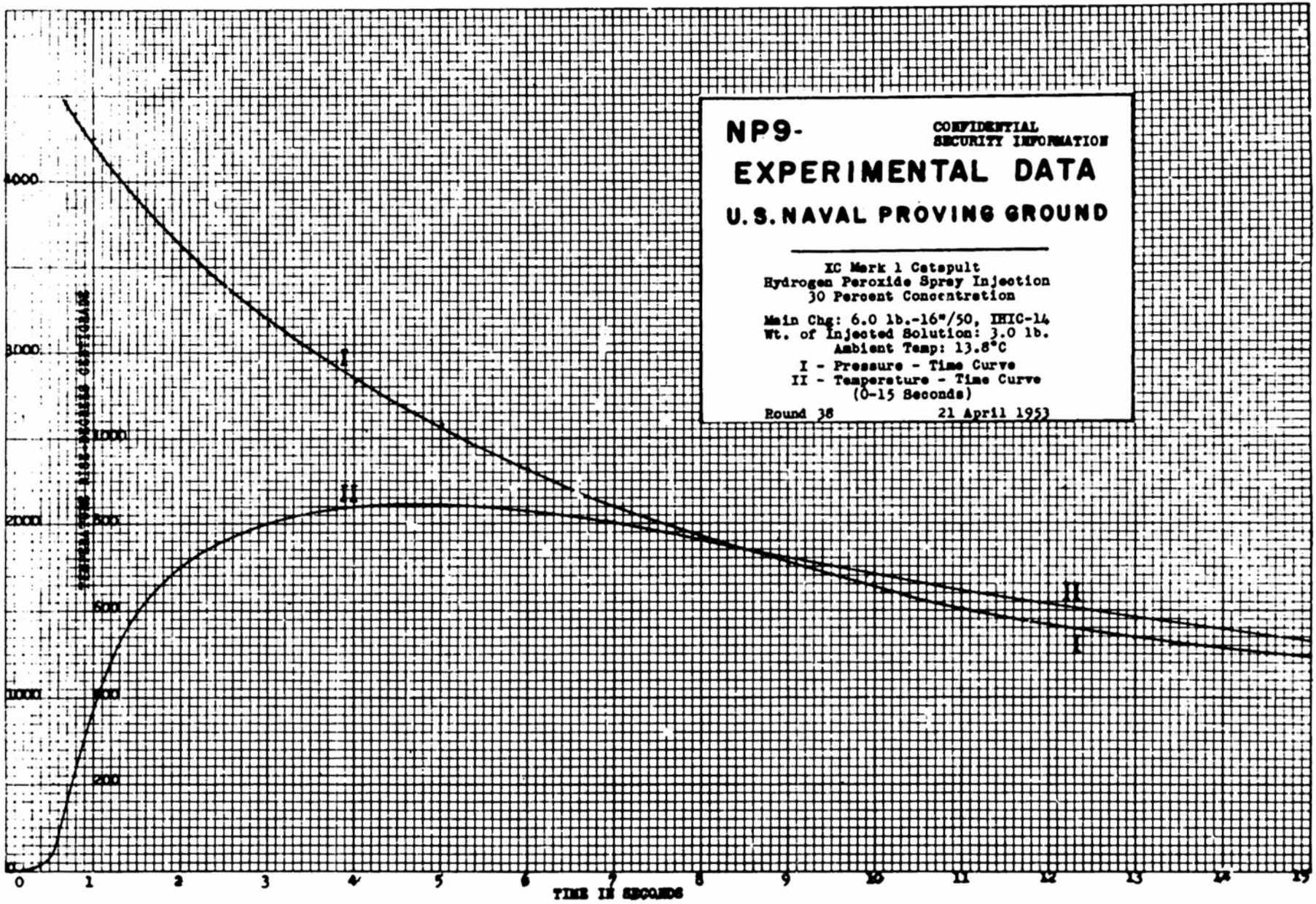

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
30 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 13.8°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 38
21 April 1953
PRESSURE - PSI
TEMPERATURE - DEGREES FAHRENHEIT
TIME IN SECONDS
I
II

FIGURE 100

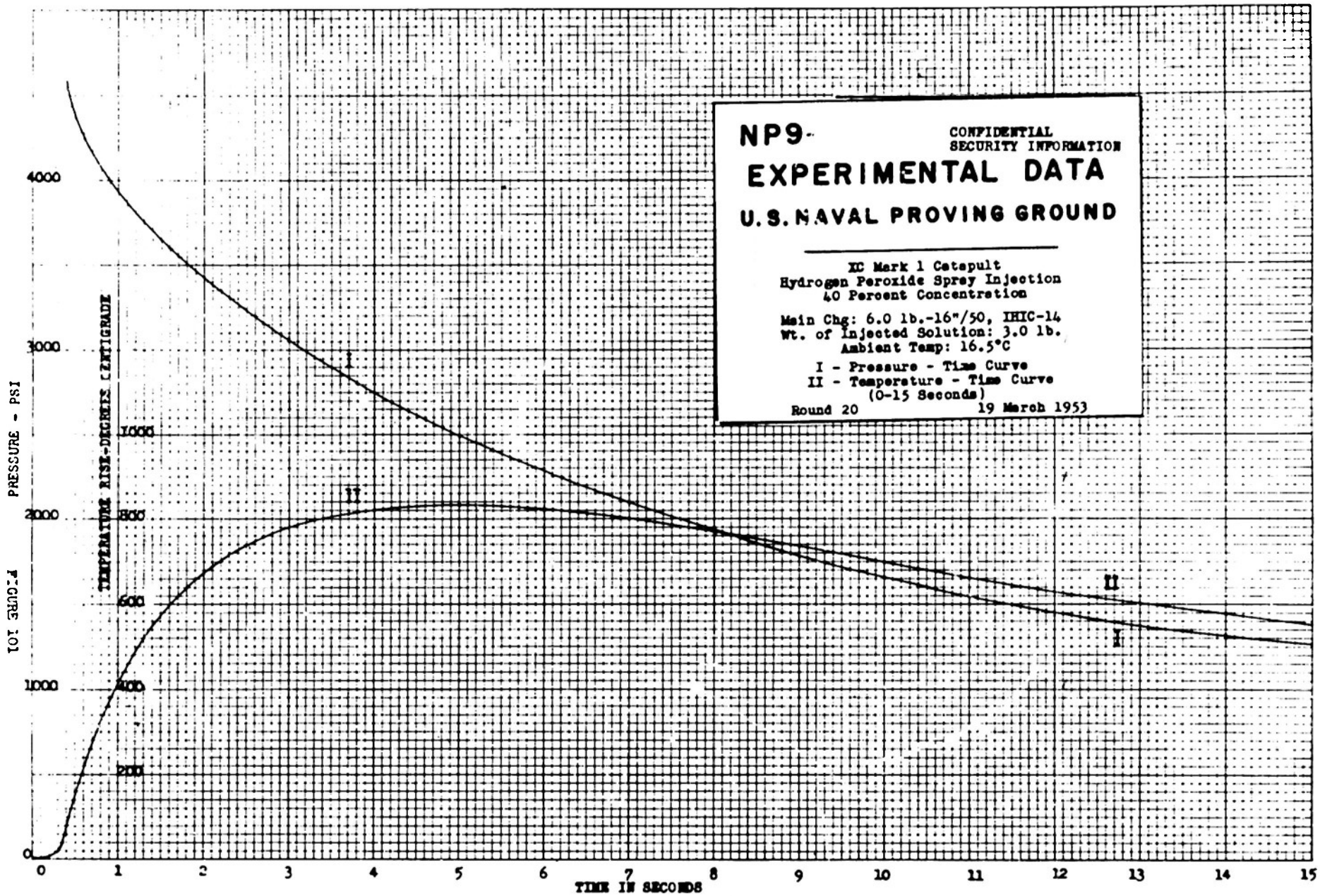

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 16.5°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 20
19 March 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 101

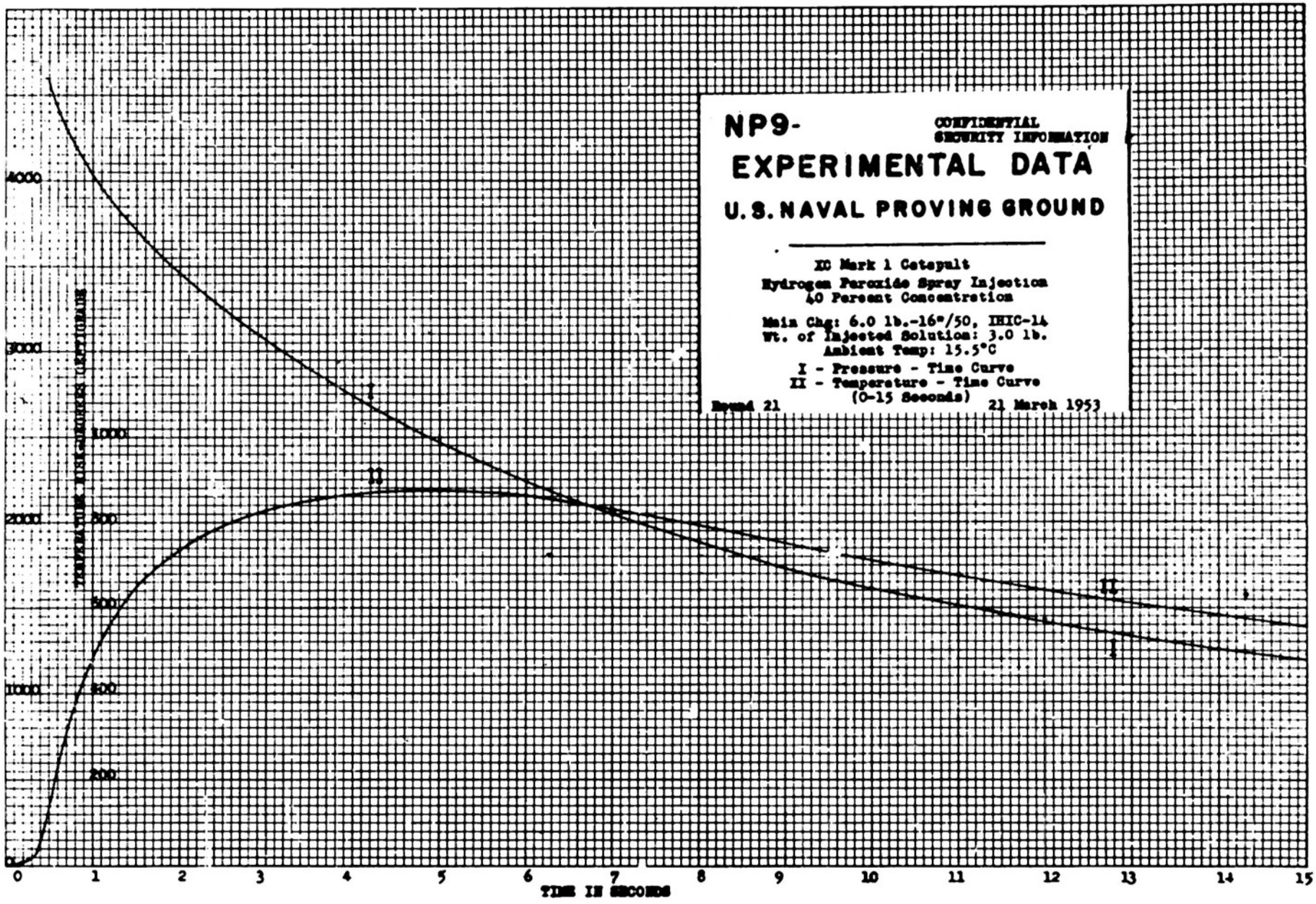

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16°/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 15.5°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 21
21 March 1953
PRESSURE - PSI
TEMPERATURE - DEGREES FAHRENHEIT
TIME IN SECONDS
4000
3000
2000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 102

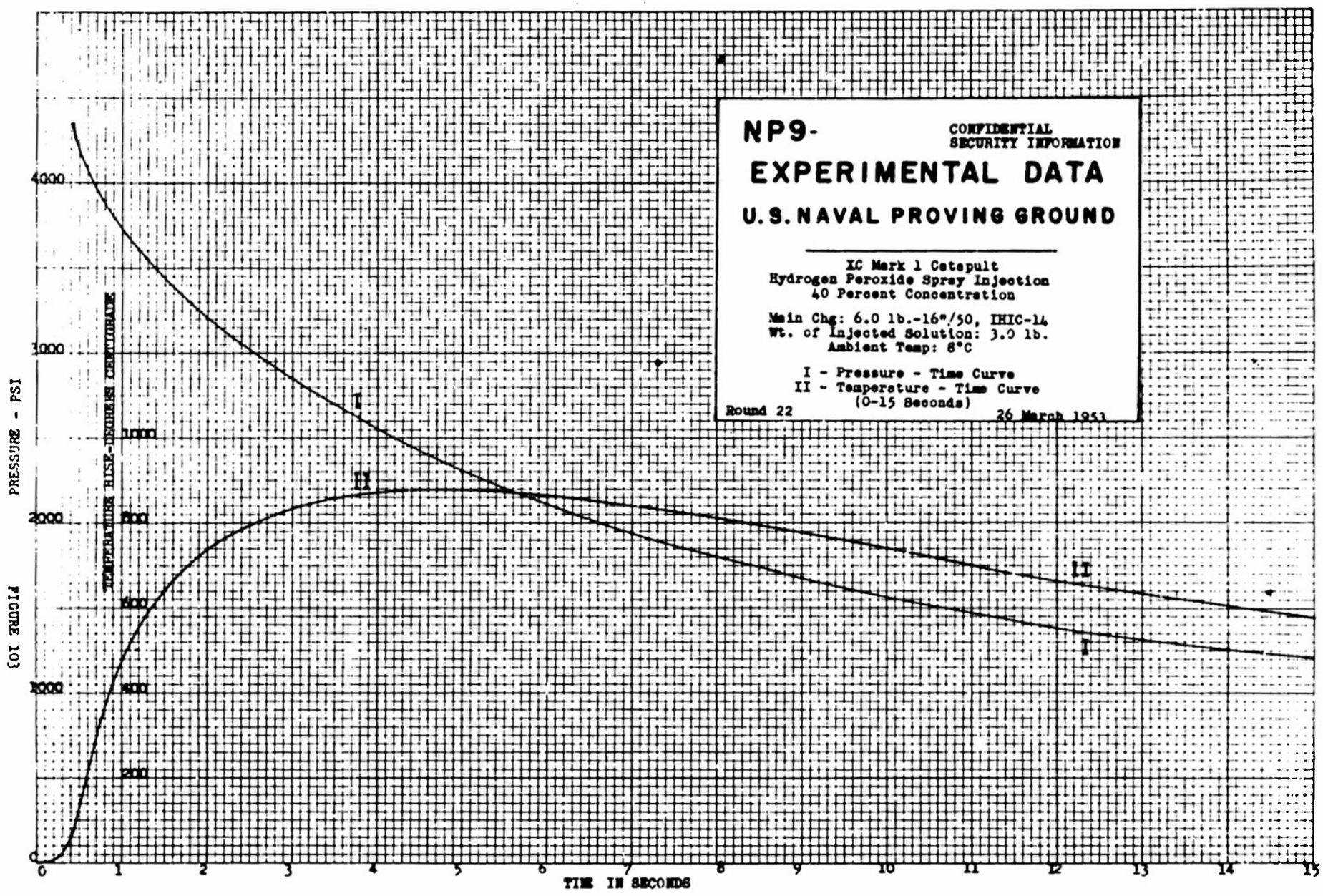

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 8°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 22
26 March 1951
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 103

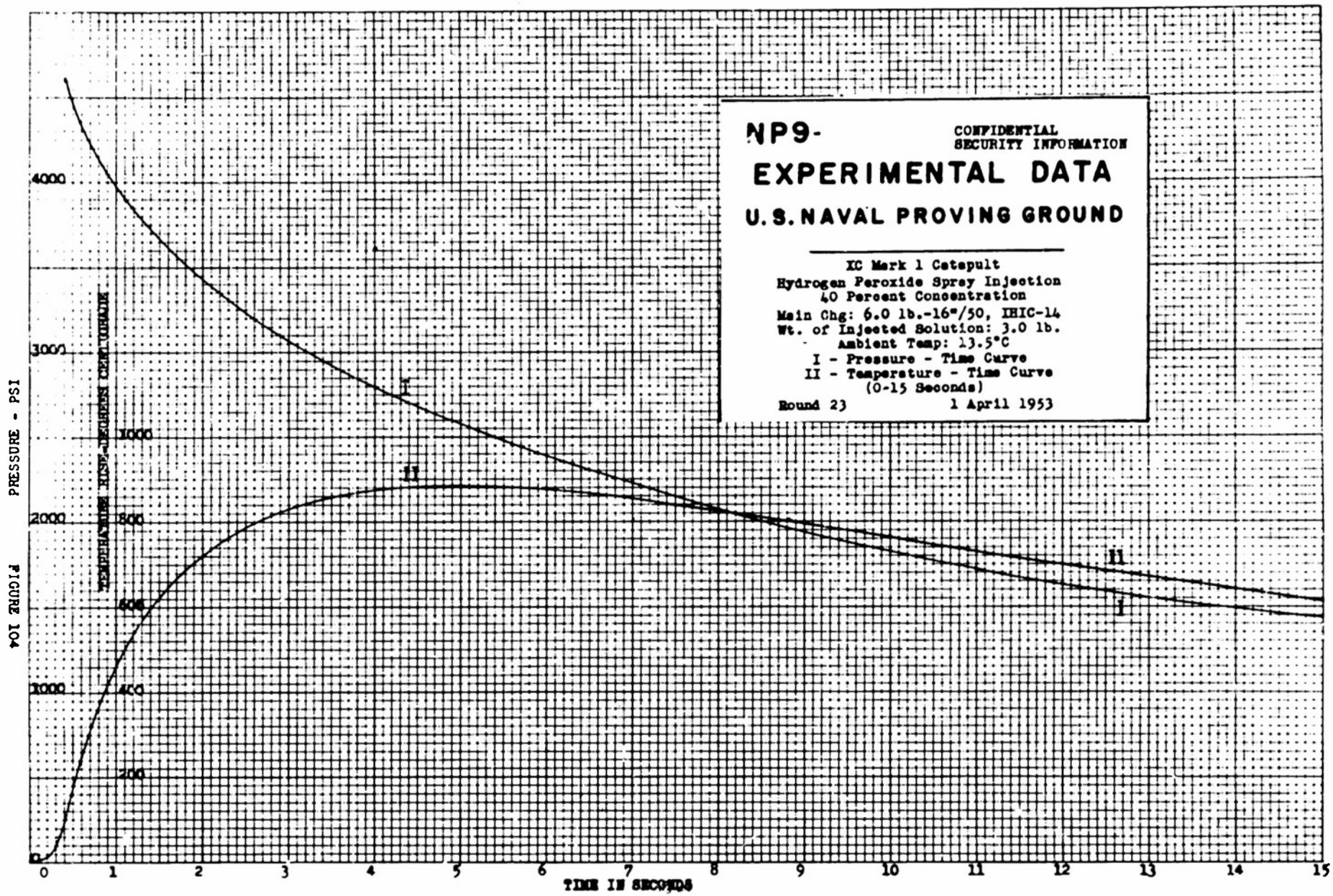
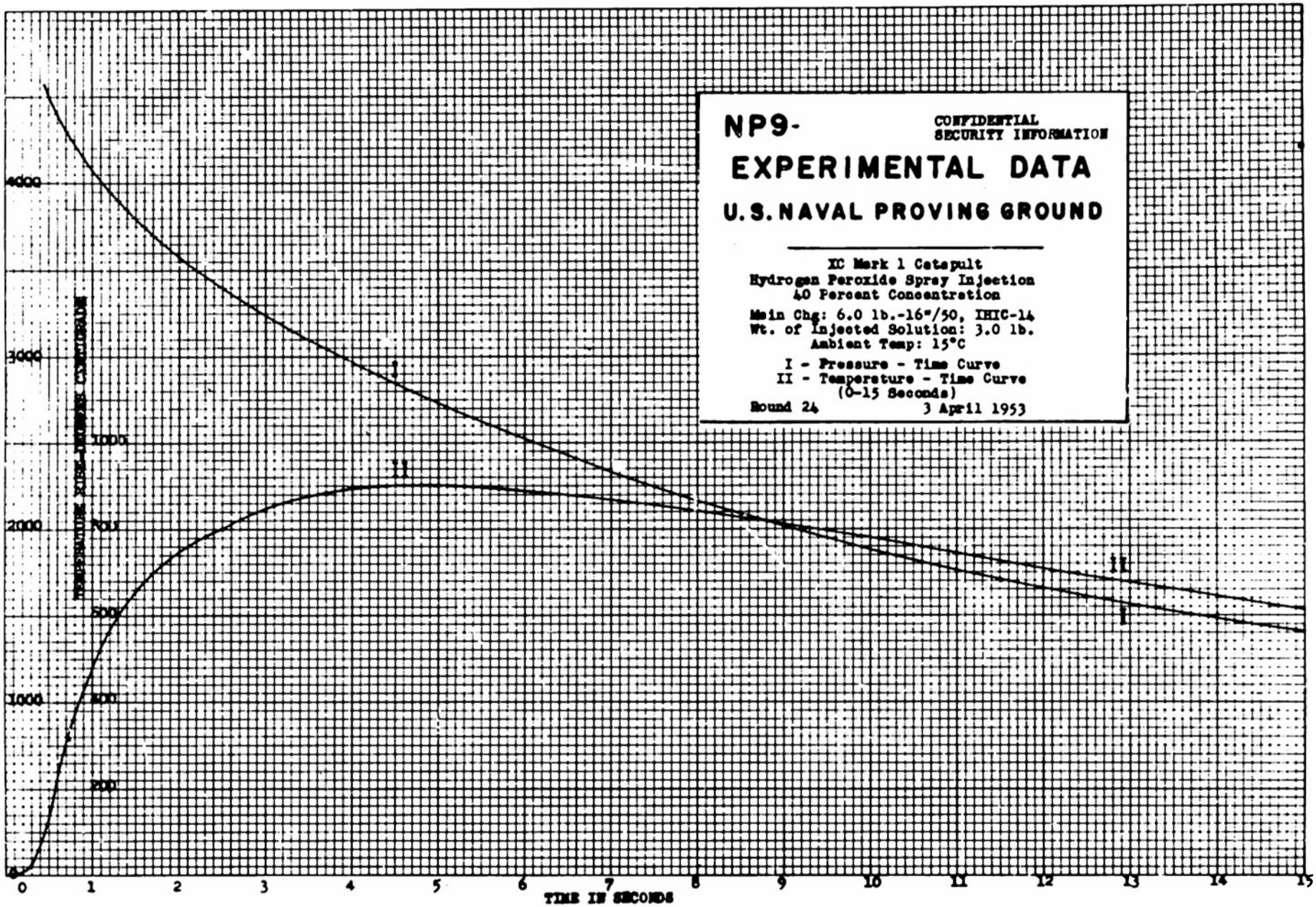

NP9-
CONFIDENTIAL
SECURITY INFORMATION
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 13.5°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 23
1 April 1953
PRESSURE - PSI
TEMPERATURE DEGREES FAHRENHEIT
TIME IN SECONDS
4000
3000
2000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 104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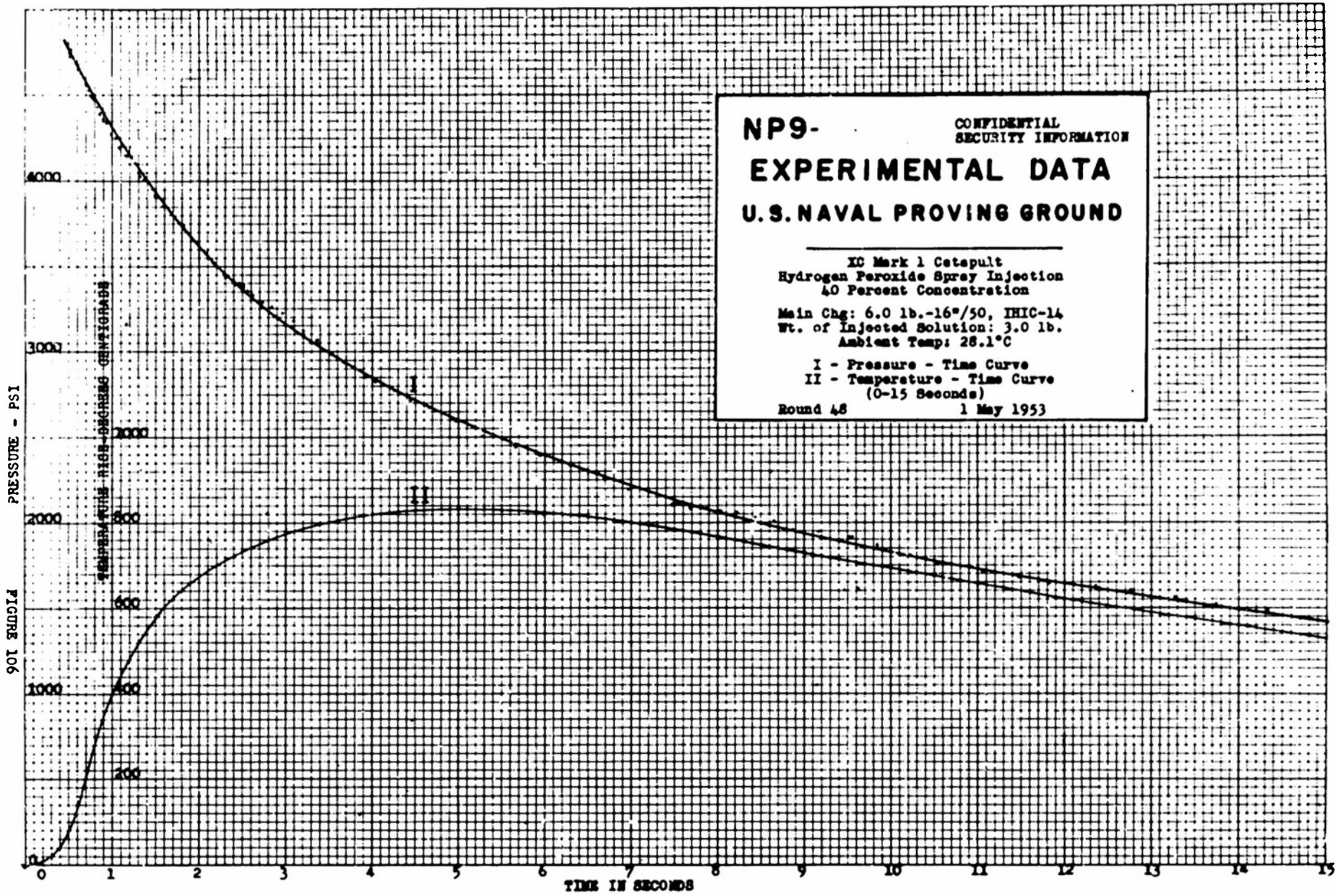
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 15°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 24
3 April 1953
PRESSURE - PSI
TEMPERATURE - DEGREES FAHRENHEIT
TIME IN SECONDS
I
II

FIGURE 105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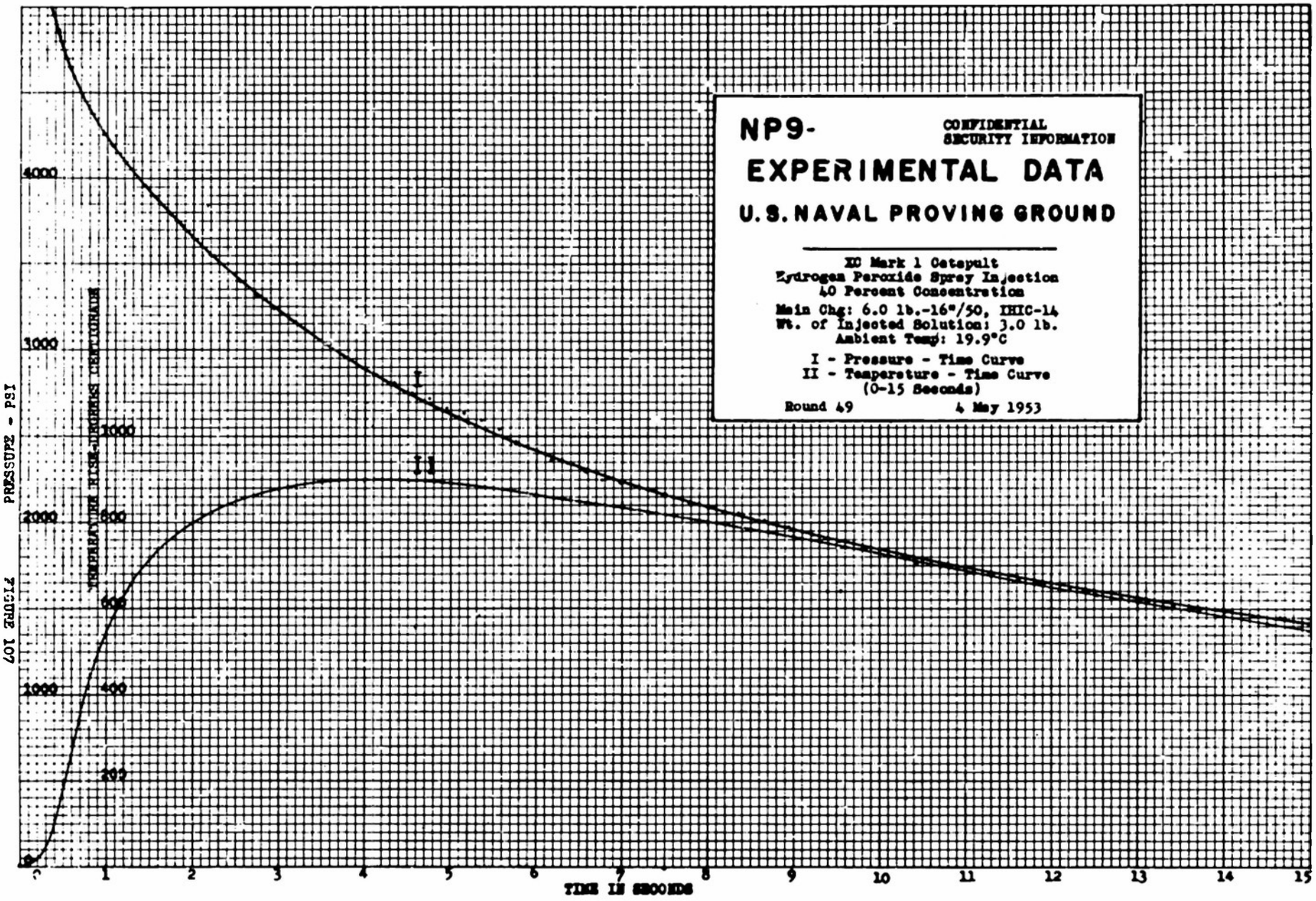
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 28.1°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 48
1 May 1953
PRESSURE - PSI
TEMPERATURE - DEGREES FAHRENHEIT
TIME IN SECONDS
I
II
0
1000
2000
3000
4000
200
400
600
800
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIGURE 106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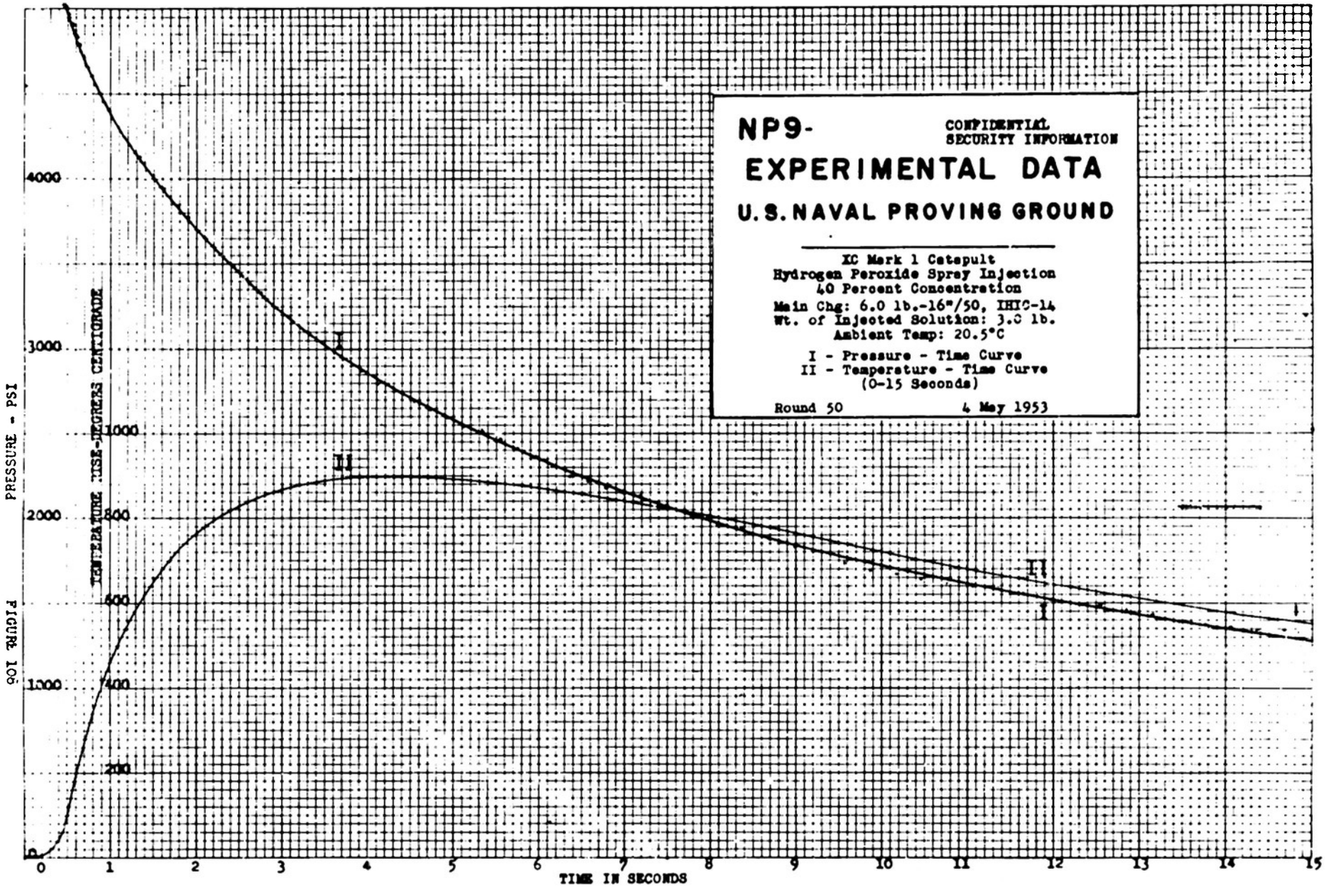
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 19.9°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 49
4 May 1953
PRESSURE - PSI
TEMPERATURE DEGREES FAHRENHEIT
TIME IN SECONDS
4000
1000
2000
1000
600
600
1000
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 107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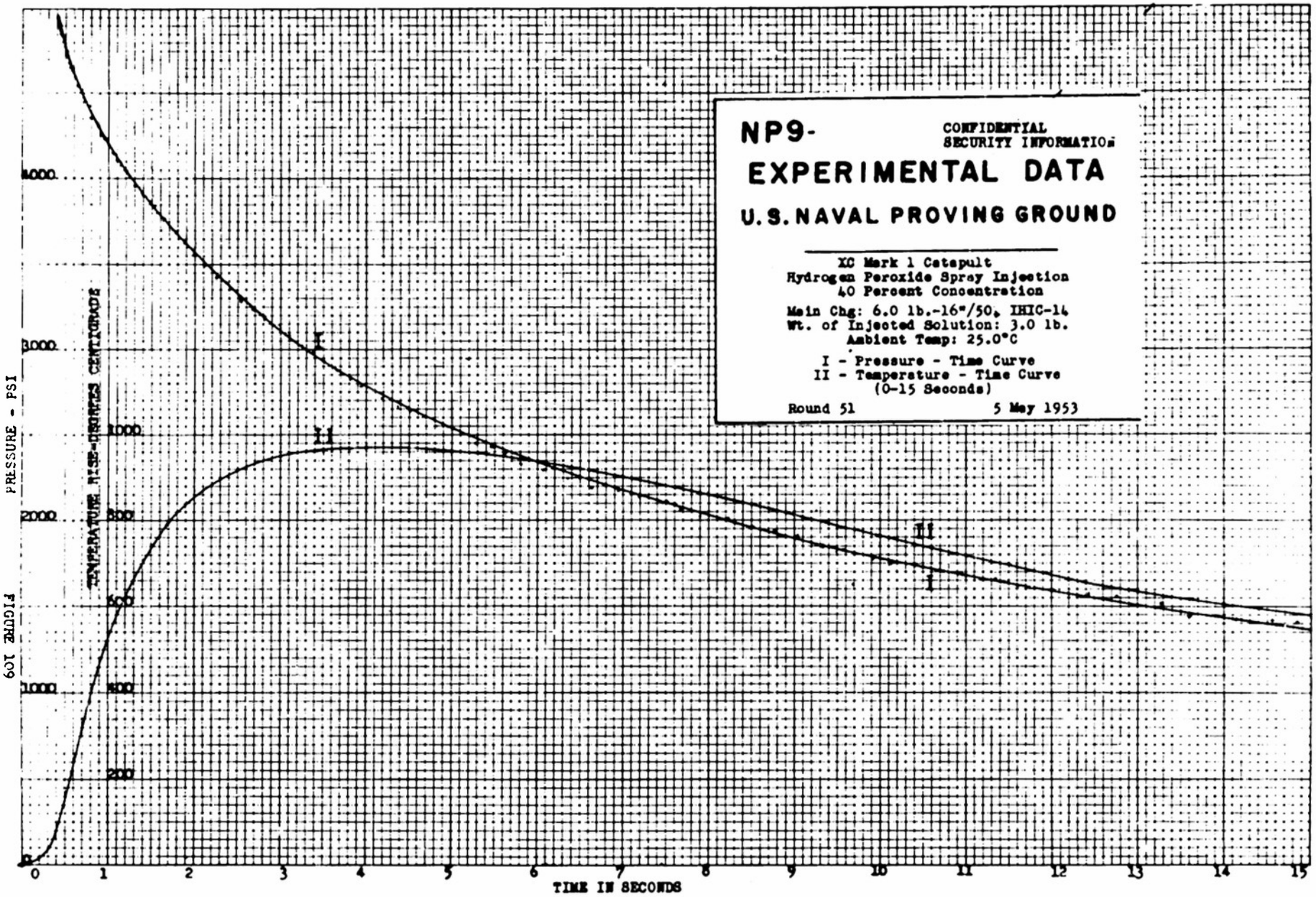
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 20.5°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 50
4 May 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 106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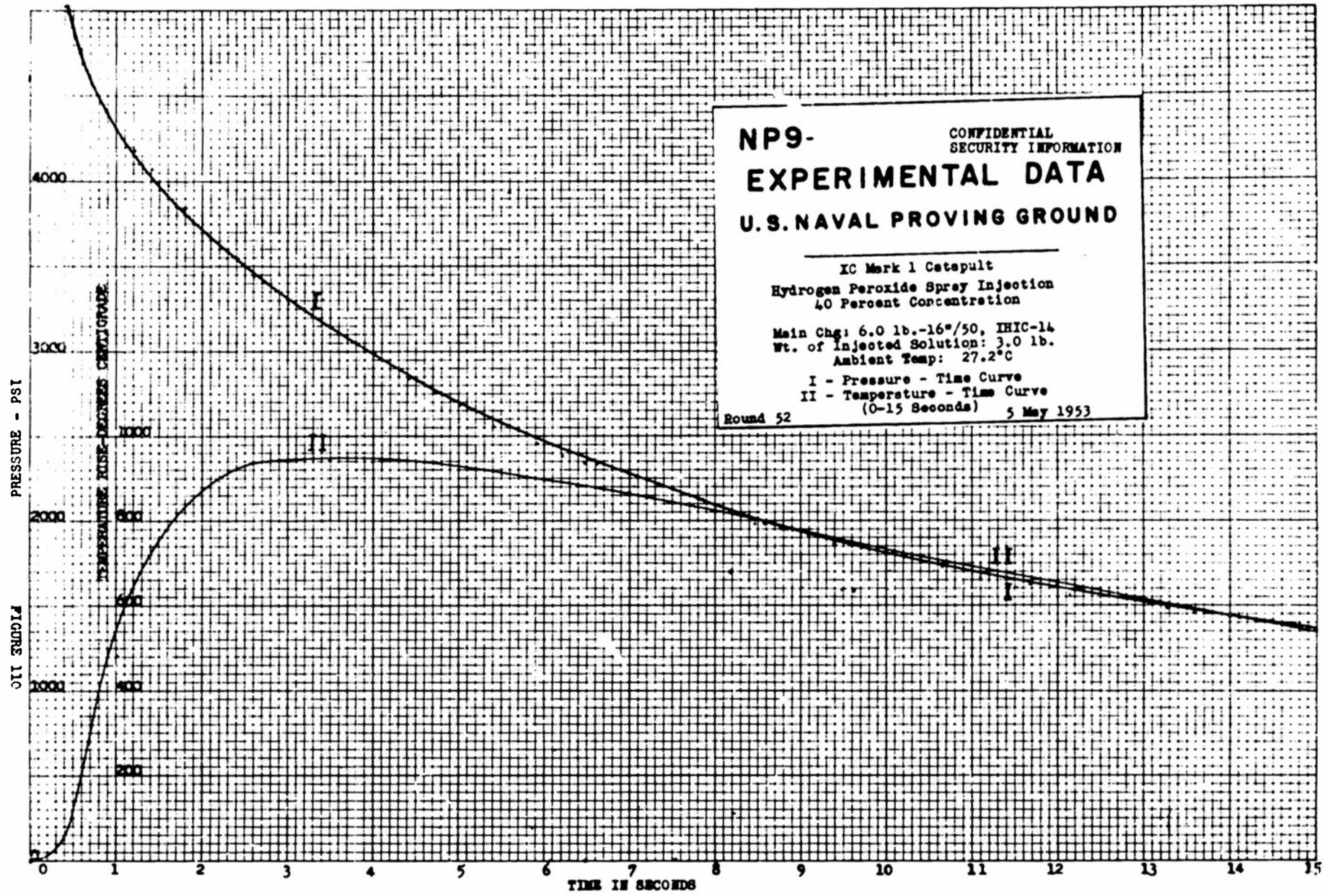
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 25.0°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 51
5 May 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 109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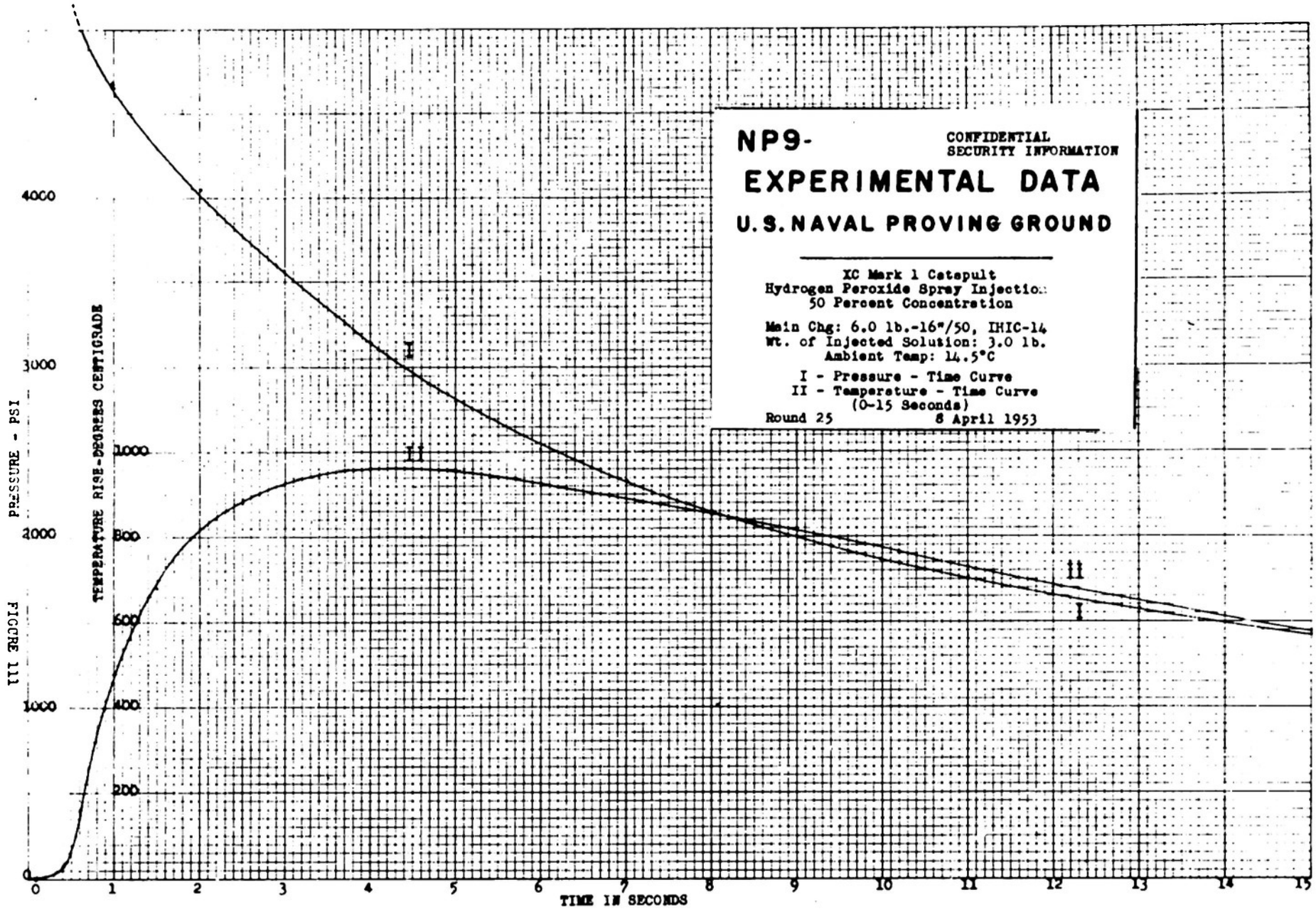
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
40 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 27.2°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 52
5 May 1953
PRESSURE - PSI
TEMPERATURE NOSE-DEGREES CENTIGRADE
TIME IN SECONDS
4000
3000
2000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 110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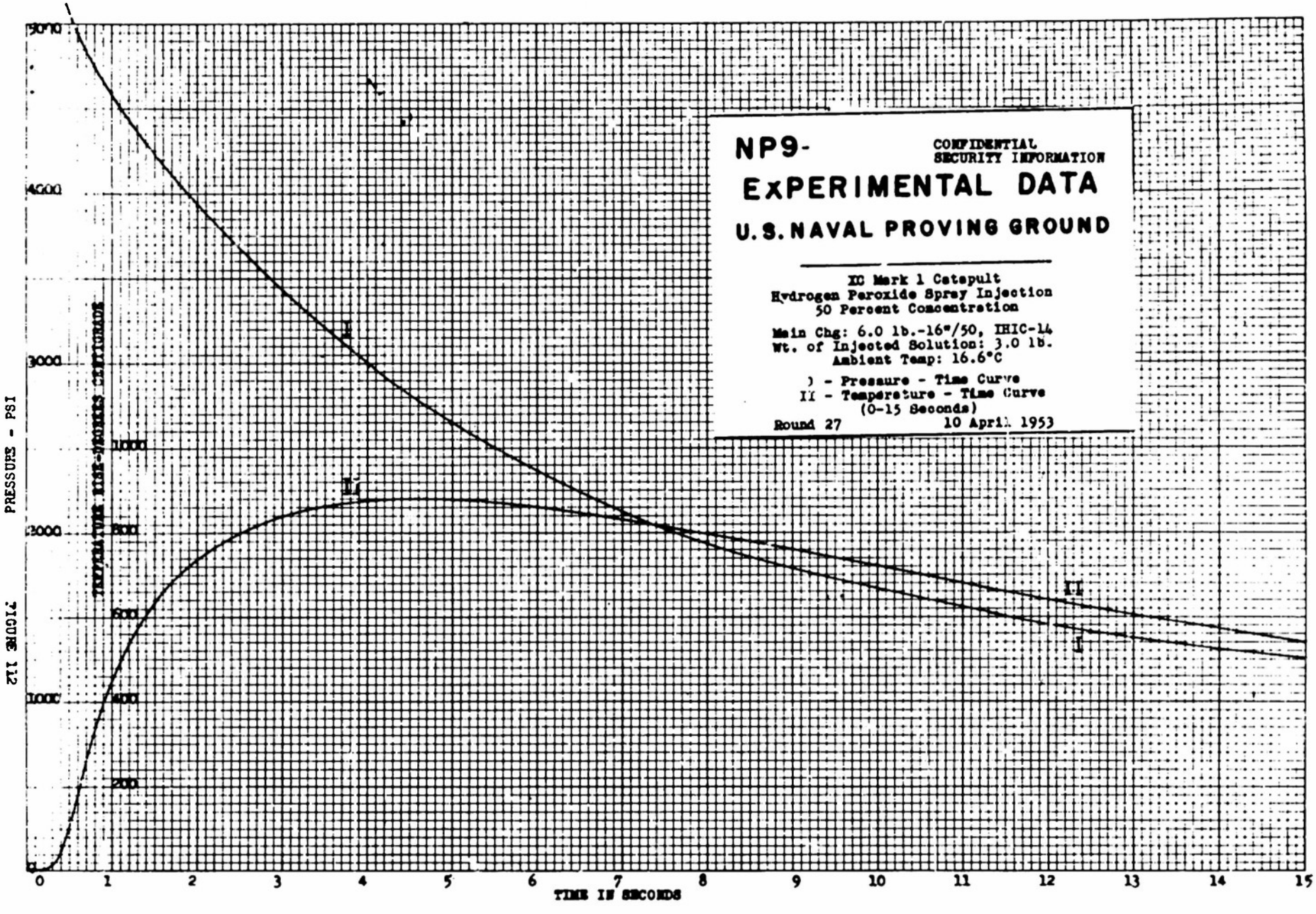
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 14.5°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 25
8 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
FIGURE III
TIME IN SECONDS
4000
3000
2000
1000
0
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II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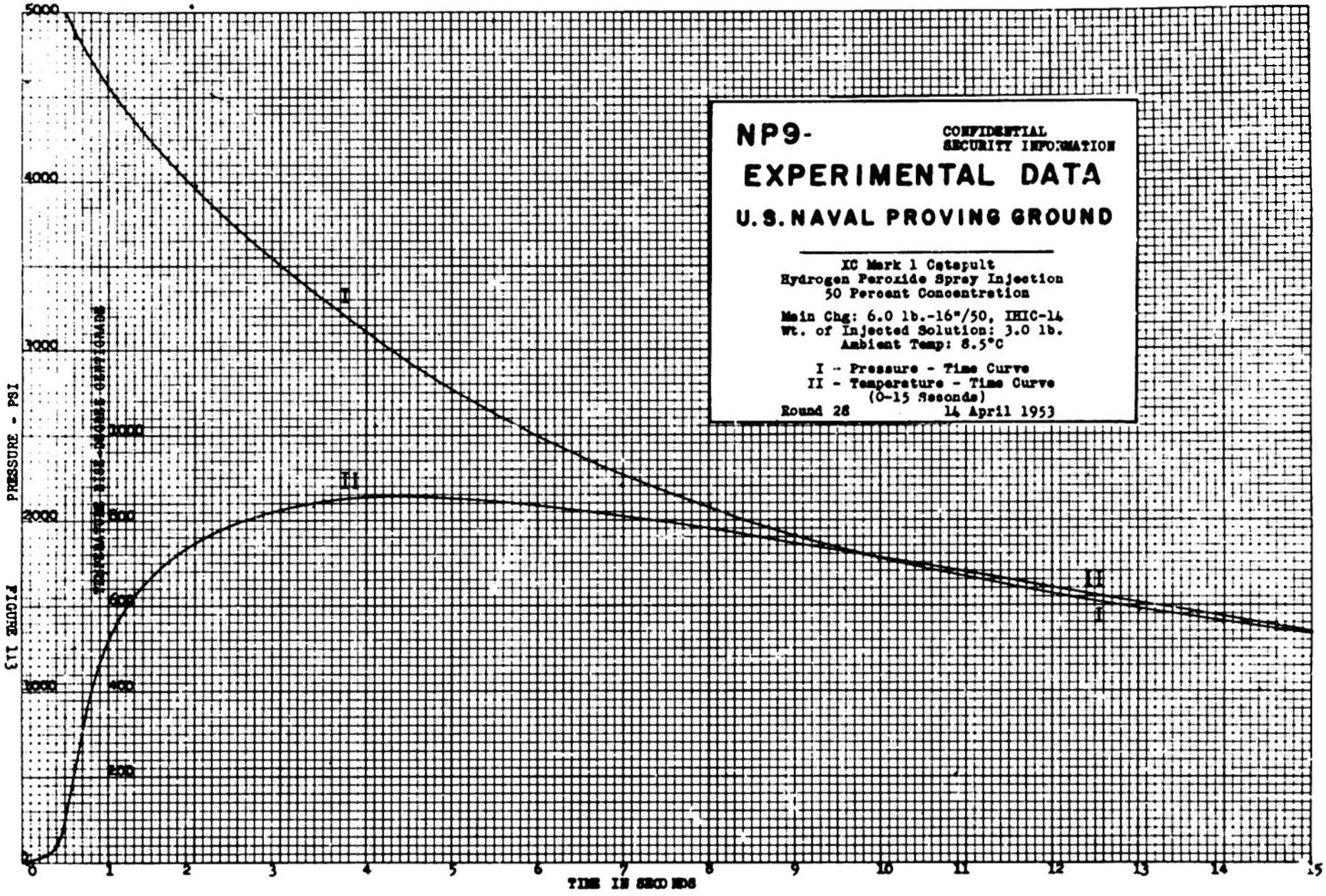
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 16.6°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 27
10 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 112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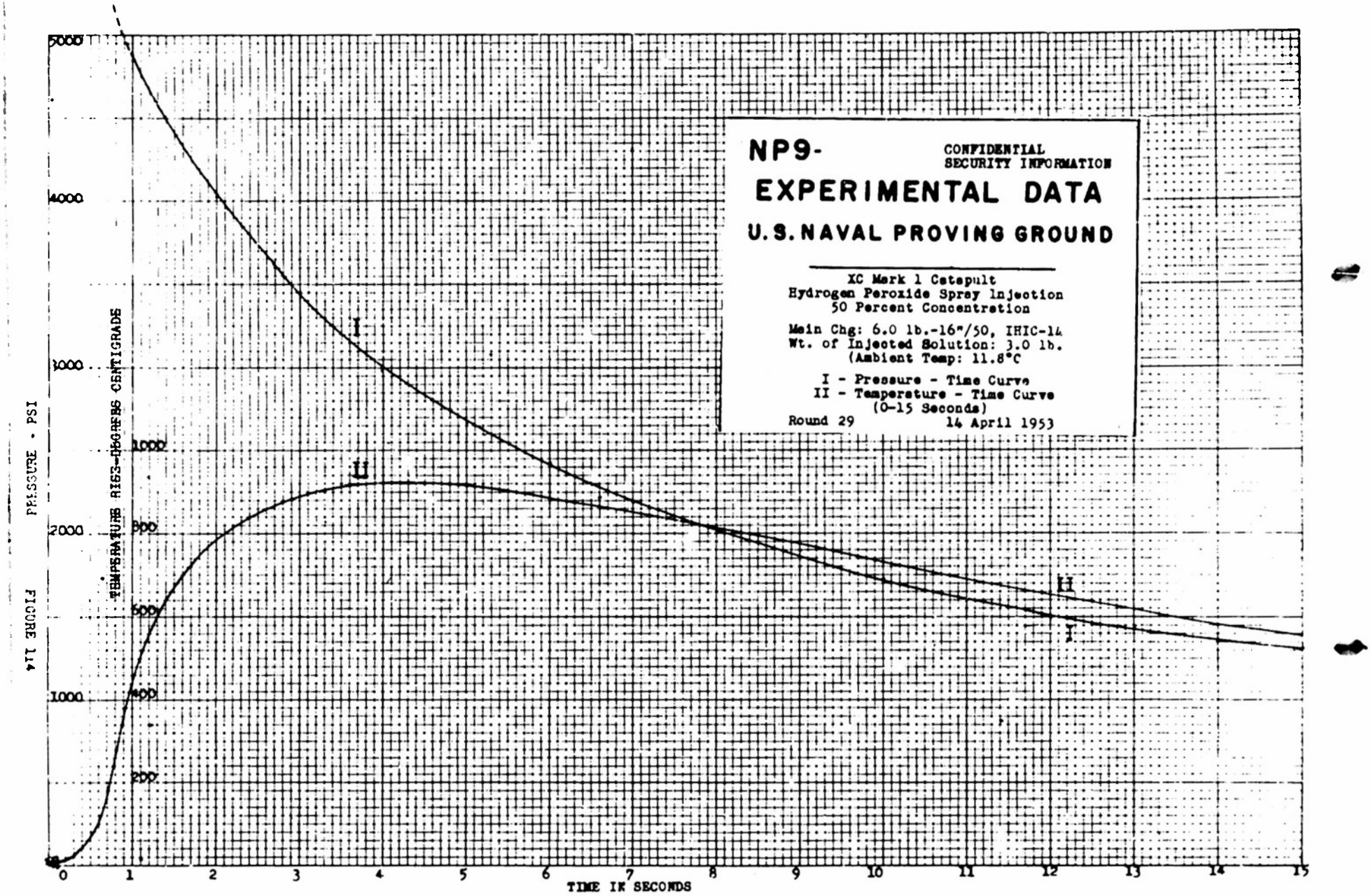
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 8.5°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 28
14 April 1953
PRESSURE - PSI
TIME IN SECONDS
I
II
III

FIGURE 113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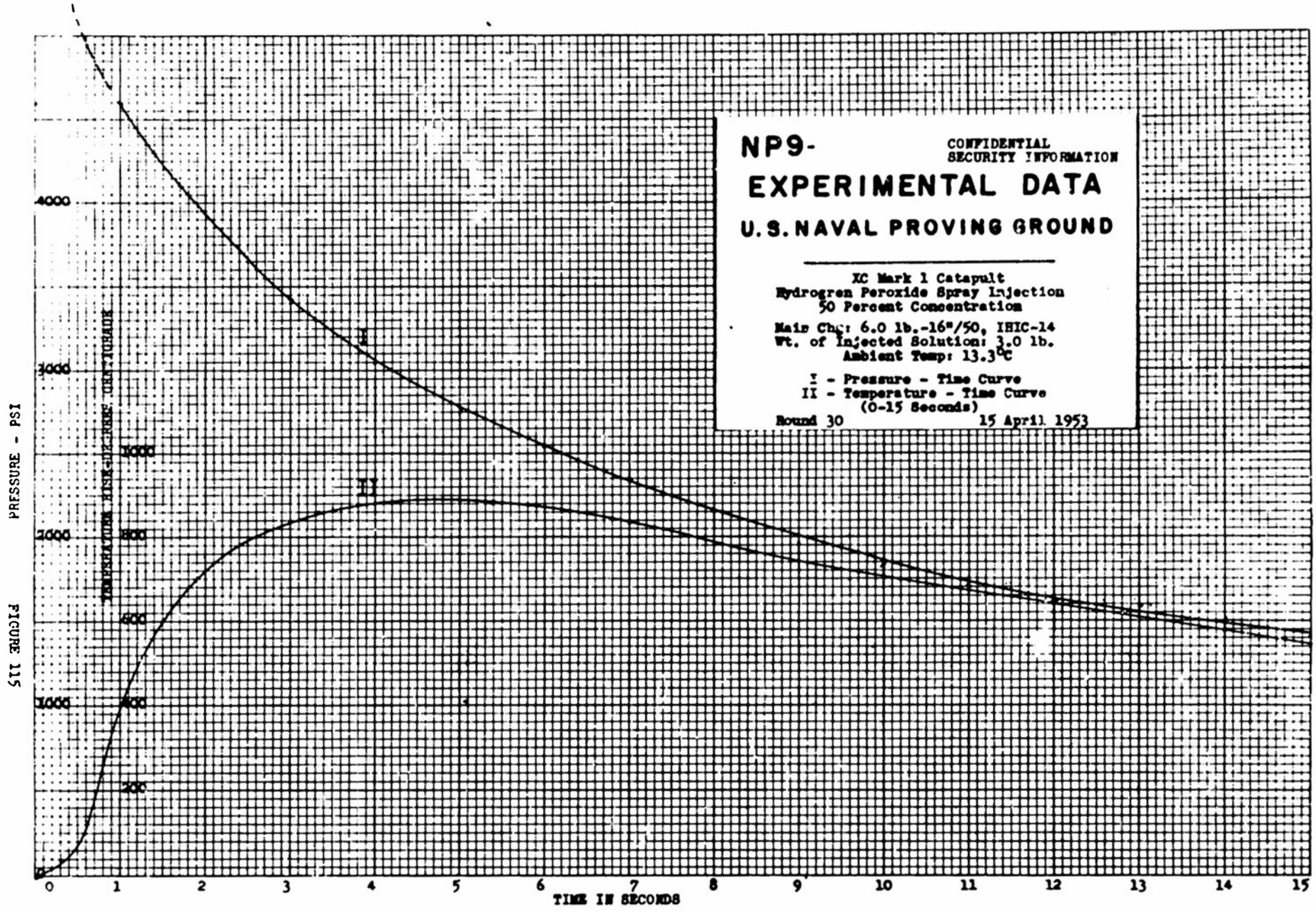
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
(Ambient Temp: 11.8°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 29
14 April 1953
PRESSURE - PSI
TEMPERATURE DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 11A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EXPERIMENTAL DATA
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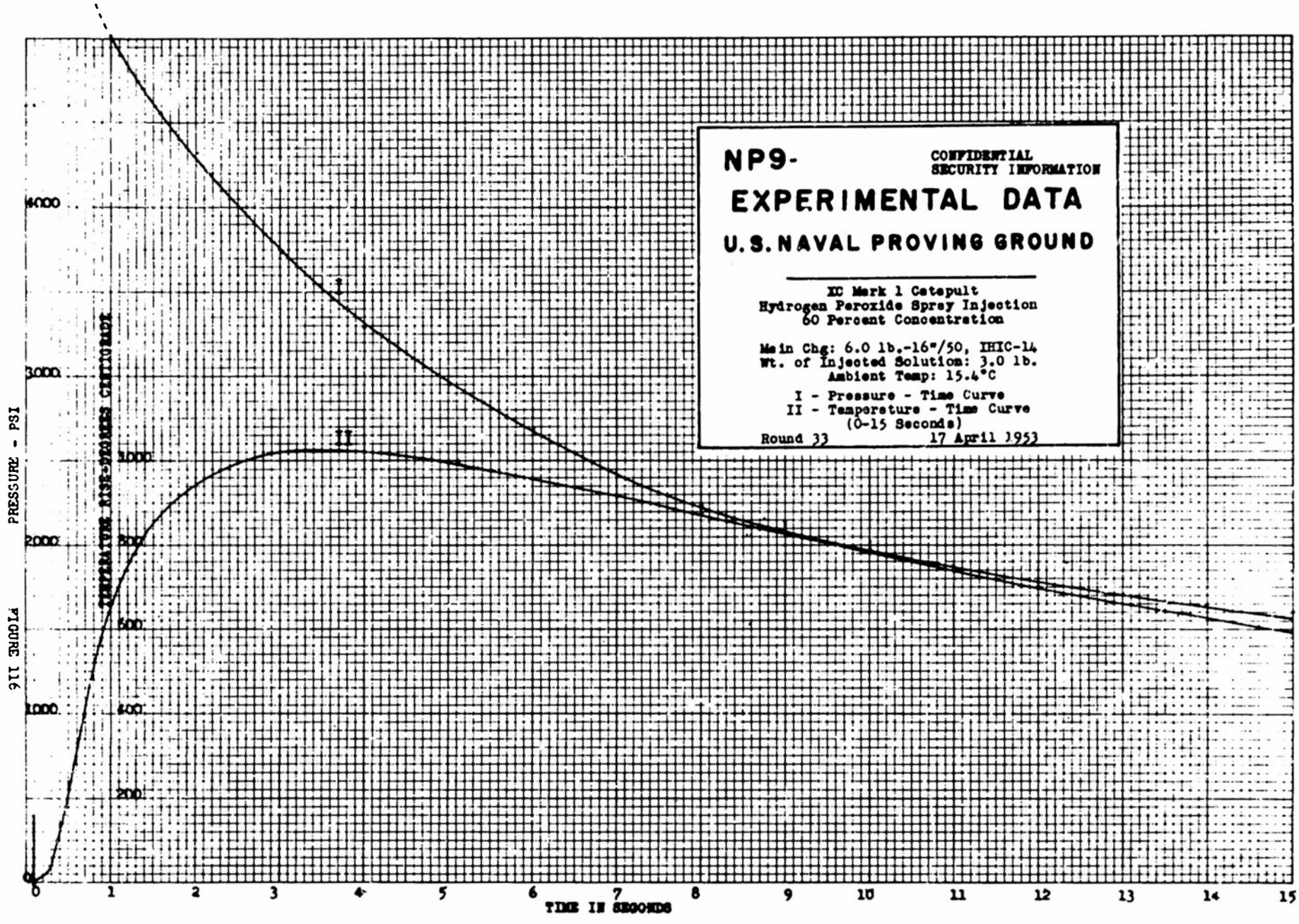
XC Mark 1 Catapult
Hydrogren Peroxide Spray Injection
50 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 13.3°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 30
15 April 1953
PRESSURE - PSI
TEMPERATURE RISE IN PRESS. CARTRIDGE
TIME IN SECONDS
I
II
4000
3000
2000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIGURE 115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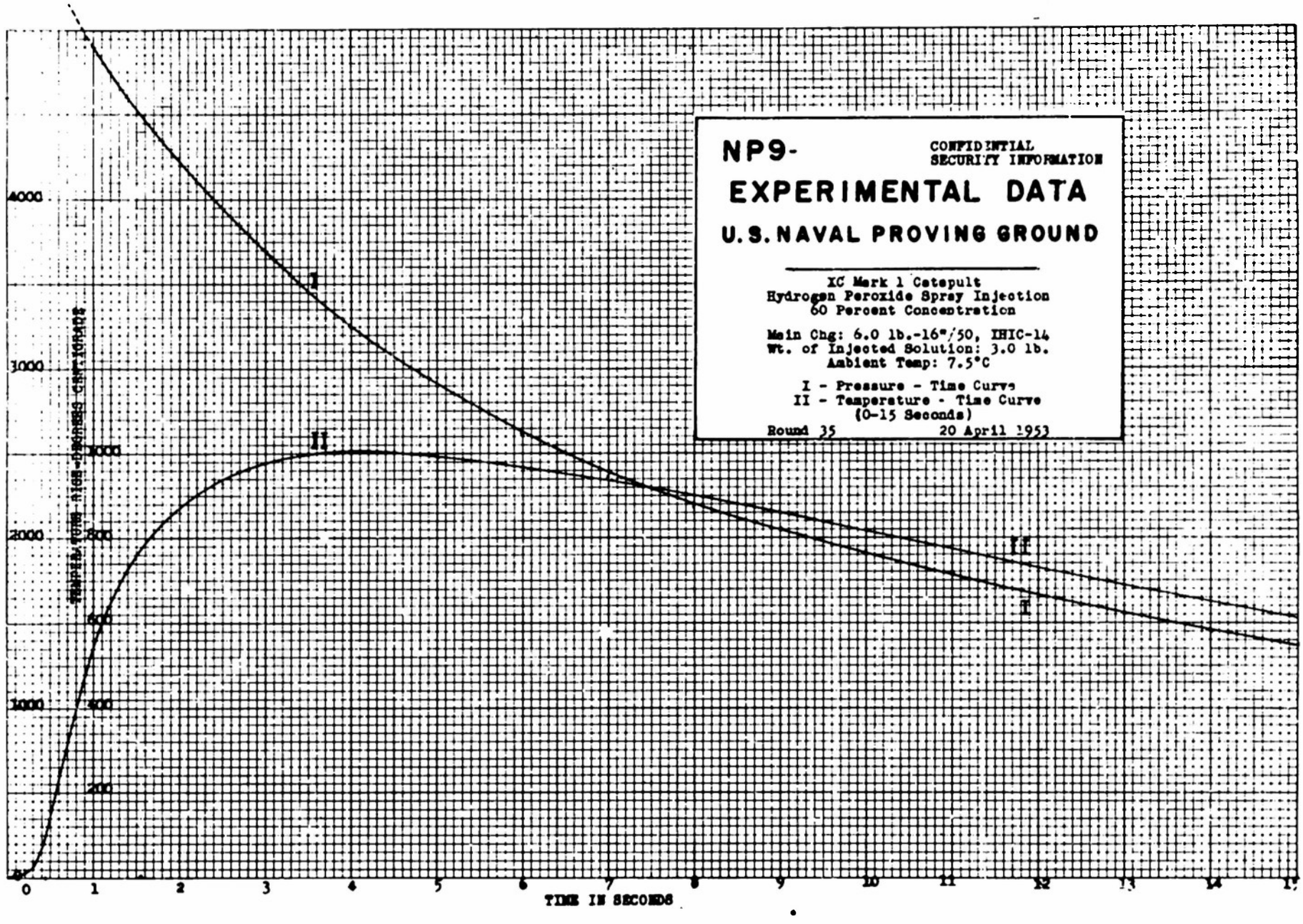
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 15.4°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 33
17 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
4000
3000
2000
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 116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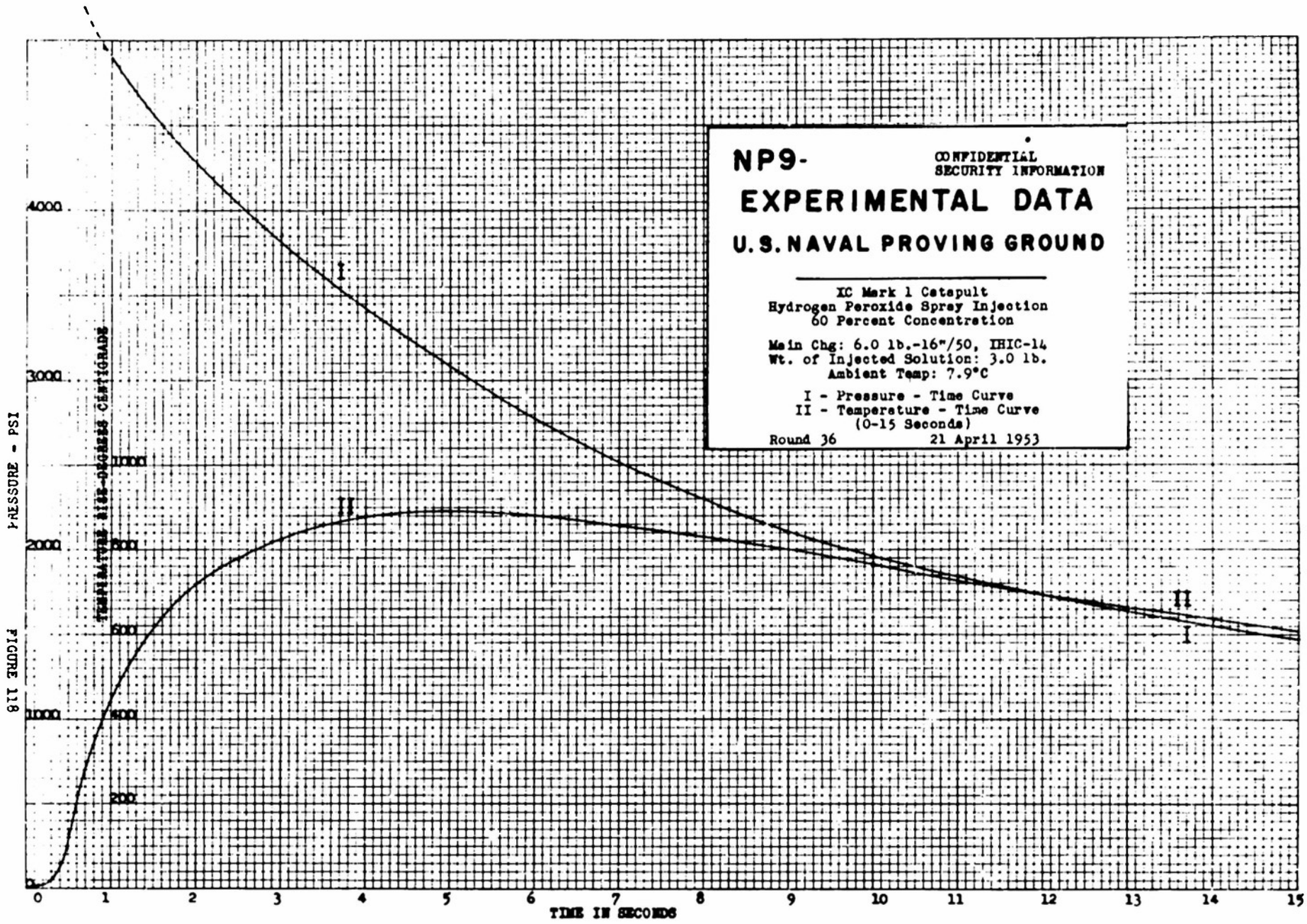
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 7.5°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 35
20 April 1953
PRESSURE - PSI
TEMPERATURE - DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 117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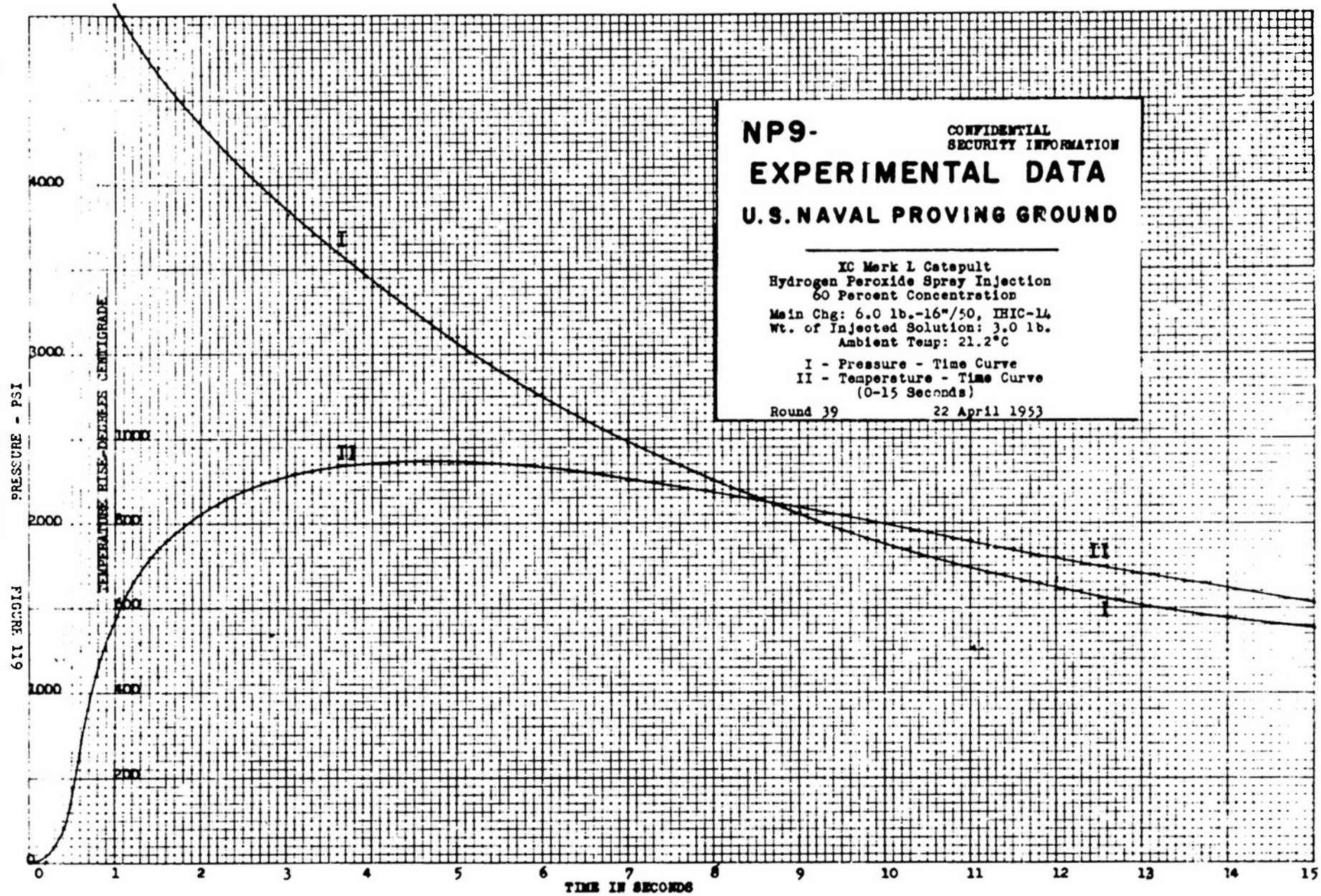
EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 7.9°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 36 21 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
4000
3000
2000
1000
0
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
I
II

FIGURE 118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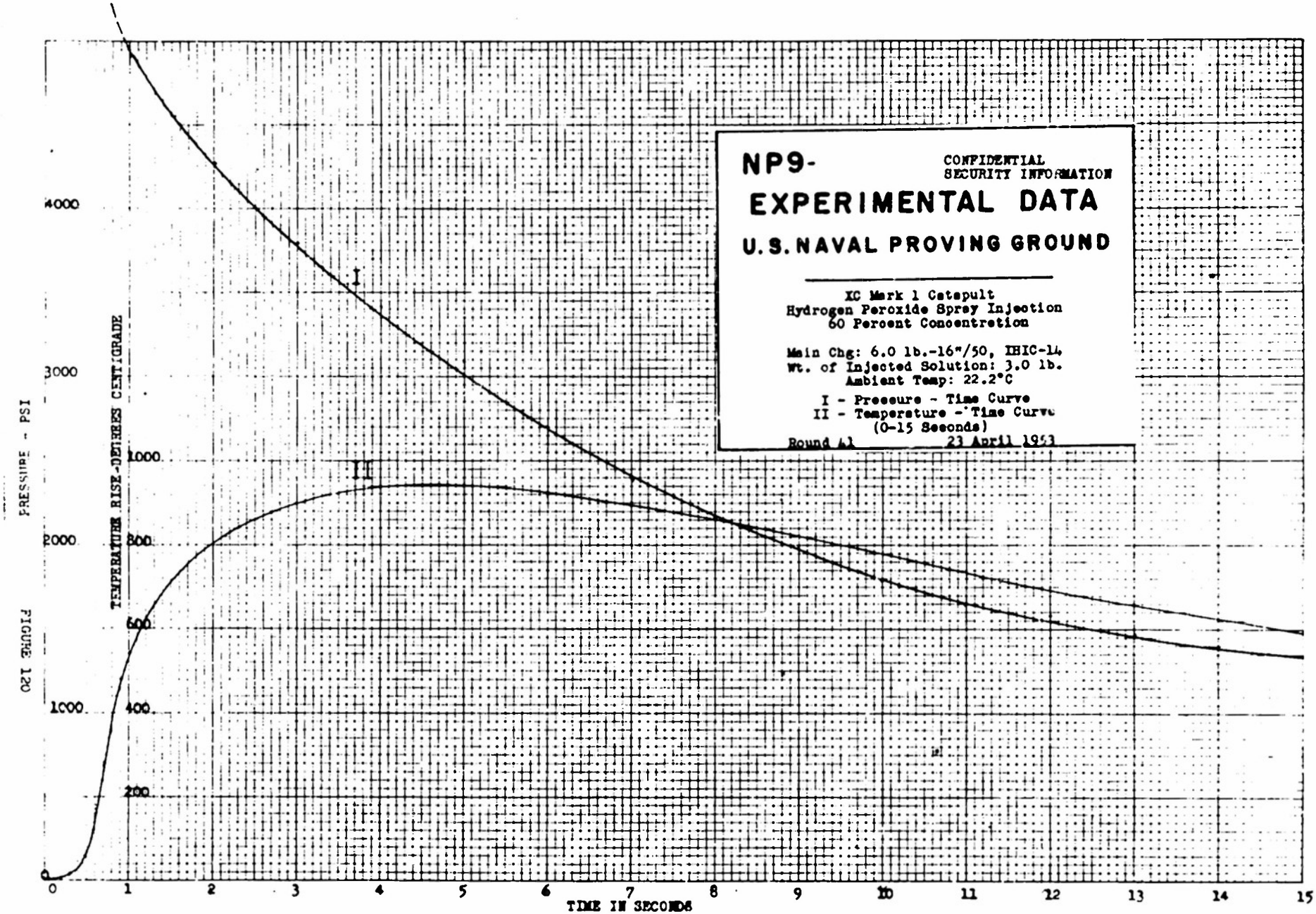
U.S. NAVAL PROVING GROUND
XC Mark L Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 21.2°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round 39
22 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II

FIGURE 119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EXPERIMENTAL DATA
U.S. NAVAL PROVING GROUND
XC Mark 1 Catapult
Hydrogen Peroxide Spray Injection
60 Percent Concentration
Main Chg: 6.0 lb.-16"/50, IHIC-14
Wt. of Injected Solution: 3.0 lb.
Ambient Temp: 22.2°C
I - Pressure - Time Curve
II - Temperature - Time Curve
(0-15 Seconds)
Round A1 23 April 1953
PRESSURE - PSI
TEMPERATURE RISE-DEGREES CENTIGRADE
TIME IN SECONDS
I
II
4000
3000
2000
1000
1000
800
600
400
200
0
1
2
3
4
5
6
7
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9
10
11
12
13
14
15

FIGURE 120

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